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TO 31S1-2TSC60-173

TECHNICAL MANUAL

SPECIAL (DEPOT) MAINTENANCE INSTRUCTIONS FOR COMMUNICATION CENTRALS

S-1
S-2

AN/TSC-60(V)1, TP-1
AN/TSC-60(V)2, Supp-C
AN/TSC-60(V)3, " -D
AND " -E
AN/TSC-60(V)4 " -F
" -G
" -H

(ROCKWELL INTERNATIONAL)
(COLLINS TELECOMMUNICATIONS SYSTEMS DIVISION)
F04606-79-C-0473

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INTRODUCTION

This manual contains maintenance procedures for Communication Centrals AN/TSC-60(V)1, AN/TSC-60(V)2, AN/TSC-60(V)3 and AN/TSC-60(V)4 not normally accomplished at the organizational/intermediate level. Use of the performance tests in this manual with the performance tests in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12 enables the technician to isolate an equipment fault to a replaceable element, a faulty card, or a discrete component where practicable.

Publications governing format and the use of abbreviations, symbols, and reference designations used in this manual are as follows:

MIL-T-9941	Technical Manuals: Ground C-E Equipment, Facility, Site and System, Preparation of
MIL-M-38730 (Amendment 1)	Manuals, Technical: General Requirements for Preparation of
MIL-STD-12C	Military Standard Abbreviations for Use on Drawings, Specifications, Standards and in Technical Documents
MIL-STD-15-1A	Graphical Symbols for Electrical and Electronic Diagrams
ASA Y32. 16-1965	Electrical and Electronic Reference Designations
MIL-STD-806B	Military Standard Graphic Symbols for Logic Diagrams
MIL-M-38784A	Manuals, Technical: General Style and Format Requirements

Collins Radio Company uses a 5-digit number to identify the configuration status of unit/subassembly. This number is referred to as the configuration identifier (CI). A typical 5-digit CI is as follows:

CI	-	69	12	5
		fiscal year	fiscal week	day of week

Whenever an electrical, mechanical, or manufaccturing change occurs, the CI changes. For example, if a subassembly configuration status identified by CI-69125 has an electrical component change on the 4th day of the 13th fiscal week, then the CI appearing on the subassemblies produced after the change would be CI-69134. The highest CI on a unit indicates the latest configuration incorporated in that unit.

NOTE

The CI number is not a serial number. Many units/assemblies may have the same CI number.

Whenever possible, the CI is marked on the unit/subassembly approximately two spaces following the 10-digit part number. When this is not practical, it is marked as close as possible to, but not immediately following, the part number. As an example, in a subassembly with many parts, the 10-digit part number may appear on one side of a subassembly and the 5-digit CI on the other.

NOTE

If two 5-digit groups appear on the same subassembly, the numerically larger (later) CI would determine configuration status.

CHAPTER 1

GENERAL INFORMATION

1-1. GENERAL.

1-2. This manual contains performance tests and adjustment procedures for circuit cards and assemblies that are part of Communication Centrals AN/TSC-60(V)1, AN/TSC-60(V)2, AN/TSC-60(V)3, and AN/TSC-60(V)4 and that are not normally accomplished at the organizational/intermediate maintenance level. Use of the performance tests in this manual with the performance tests in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12 enables the technician to isolate faults to a replaceable element, a faulty card, or a discrete component where practicable. Table 1-1 lists circuit cards that are tested at a facility equipped with a Hewlett-Packard Model 9500D-224 Automatic Test System. Maintenance procedures for testing circuit cards with the 9500D-224 are in the related Technical Orders listed in table 1-1 and are not included in this manual.

1-2. RELATED PUBLICATIONS.

1-3. Related publications to be used with this manual are listed in tabe 1-2.

Table 1-1. Circuit Cards Tested on Automatic Test System

NAME	REFERENCE DESIGNATION	PART NUMBER	APPLICABLE TECHNICAL ORDER
CONTROL - MONITOR OK-145/TSC-60(V) (Radio Control Group)	1A8/1A15		
Audio Control Card	A1	783-1427-001	31S1-2TSC60-8-3
Logic Level Slave Card	A7A1/A8A1	793-9260-001	31S1-2TSC60-8-23
Hardwire Memory Card	A7A2	789-2620-001	31S1-2TSC60-8-24
CCCS Timing Card	A7A3	789-2618-001	31S1-2TSC60-8-25
Processor Card	A7A4	789-2622-001	31S1-2TSC60-8-27
Instruction Decode Card	A7A5	789-2624-001	31S1-2TSC60-8-7
Accessible Memory Card	A7A6	793-8982-001	31S1-2TSC60-8-29
Matrix Card	A7A7/A8A2	789-2612-001	31S1-2TSC60-8-26
Inverter Board	A7A10PS1A2/ A8A5PS1A1	793-9322-001	
Control Board	A7A10PS1A1/ A8A5PS1A1	793-9321-001	

Table 1-1. Circuit Cards Tested on Automatic Test System (Cont)

NAME	REFERENCE DESIGNATION	PART NUMBER	APPLICABLE TECHNICAL ORDER
Printed Circuit Board TS-3097/TSC-60(V) (Auxiliary Control Module)	Replaces A7A2 for tests.	795-8751-001	31S1-2TSC60-8-20
Indicator Panel SB-3390/TSC-60(V) (Maintenance Display Unit)	1A10		
DCU Card	A1	783-9458-003	31S1-2TSC60-8-17
Negative 12-volt Regulator Card	A2	789-2632-001	31S1-2TSC60-8-11
Maintenance Interface Card	A3	793-9169-001	31S1-2TSC60-8-4
Primary Register Card	A4	789-2600-001	31S1-2TSC60-8-16
Monitor Data Register Card	A5	789-2604-001	31S1-2TSC60-8-12
Multimeter Display Register Card	A6	793-9166-001	31S1-2TSC60-8-8
Control Link Monitor/ Radio Register Card	A7	789-2606-001	31S1-2TSC60-8-13
Control Board	PS1A1	793-9321-001	
Inverter Board	PS1A2	793-9322-001	
Audio Frequency Monitor ID-1688/TSC-60(V) (Monitor Switching Panel)	1A14		
Monitor/Switching Card	A1	783-1422-001	31S1-2TSC60-8-6
Antenna Coupler CU-1896/TSC-60(V)1 (490T-8 Antenna Coupler)	N/A		
Coupler Control Adapter Card	A11	778-3503-001	31S1-2TSC60-8-18
Coupler Control Card 1	A9	775-4398-001	31S1-2TSC60-8-9
Coupler Control Card 2	A10	778-2842-001	31S1-2TSC60-8-10

309H-1 Antenna Coupler Control (Deleted)

Table 1-1. Circuit Cards Tested on Automatic Test System (Cont)

NAME	REFERENCE DESIGNATION	PART NUMBER	APPLICABLE TECHNICAL ORDER
309H-1 Antenna Coupler Control	A2		
DCU Card	A1	793-9414-002	31S1-2TSC60-8-19
DCFE Card	A2	793-9153-001	31S1-2TSC60-8-28
Tune Sequence Card	A3	778-2863-001	31S1-2TSC60-8-14
Tune Sequence Card	A4	778-2864-001	31S1-2TSC60-8-1
Tune Sequence Card	A5	778-2865-001	31S1-2TSC60-8-5
Servo Amplifier Card	A6/A8	778-2916-001	31S1-2TSC60-8-15
Servo Compensation Card	A7	778-2867-001	31S1-2TSC60-8-2
Radio Frequency Amplifier AM-4699/ARC-132 (648A-1P RF Amplifier)	A29A2/AA29A3		
Band Logic Card	A3	775-0939-001	31S1-2TSC60-8-22
ADC/Keyer Card	A11	775-0946-002	31S1-2TSC60-8-21

Table 1-2. Related Publications

T.O. NUMBER	TITLE
31S1-2TSC60-2	Combined Operation and Maintenance Instructions for Communication Central AN/TSC-60(V)1
31S1-2TSC60-4	Illustrated Parts Breakdown Communication Central AN/TSC-60(V)1
31S1-2TSC60-12	Combined Operation and Maintenance Instructions for Communication Central AN/TSC-60(V)2 and AN/TSC-60(V)3
31S1-2TSC60-14	Illustrated Parts Breakdown Communication Centrals AN/TSC-60(V)2, AN/ TSC-60(V)3 and AN/TSC-60(V)4
33A1-121	Operation and Maintenance Instructions with Parts List, AN/TSC-60(V) Test Set Adapters

CHAPTER 2

MAINTENANCE

2-1. GENERAL.

2-2. This chapter contains performance tests and adjustment procedures not normally accomplished at the organizational/intermediate level. Table 2-1 lists test equipment authorized only at a depot facility. For characteristics of additional test equipment authorized at the organizational/intermediate level and at depot facilities, refer to the Test Equipment Required for Equipment Maintenance tables in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12. All of the test equipment required to perform a specific performance test is listed at the beginning of the performance test table. For theory of operation and circuit diagrams of the equipment being tested, refer to the related technical order listed in the Equipment Supplied tables in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12. Maintenance procedures for the circuit cards listed in table 1-1 are in the applicable Technical Order referenced in the table.

2-2. CONTROL-MONITOR OK-145/TSC-60(V) (RADIO CONTROL GROUP).

2-3. All the circuit cards in the radio control group are tested by the HP-9500D-224 Automatic Test System. The following procedures augment the diagnostic tests of the transmit and receive control heads in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12. These additional diagnostic tests can be performed at any AN/TSC-60(V) facility that has two SM-637/G Signal Data Indicator Simulators (7404A-1 Source Generator Display Unit).

2-4. DIAGNOSTIC TESTS. Before performing the following test of the transmit and receive control heads of the OK-145/TSC-60(V), perform transmit and receive control heads diagnostic tests 1 through 6 listed in T.O. 31S1-2TSC60-2 or T.O. 31S1-2TSC-12. When these tests are successfully completed, proceed as follows:

a. Initiate subtest 0-8 as follows. This subtest outputs data stored in accessible memory register 6 and stores monitor responses in accessible memory registers 4, 5, 6, and 7.

1. At power distribution box 1A32, set RCVR EXCITER and POWER AMPL circuit breakers CB2 and CB3 to OFF.

Table 2-1. Test Equipment Authorized for Special Maintenance

TEST EQUIPMENT	CHARACTERISTIC
Signal Data Indicator Simulator SM-637/G (Source Generator Display Unit) 2 required	See T.O.33A1-8-615-1.
RF Vector Impedance Meter, HP-4815A	Frequency range: 500 kHz to 108 MHz Accuracy: ±2% of reading Rf monitor output: 100 mV into 500 ohms Measurement range: 1 ohm to 100 kilohms
Wattmeter, AN/URM-120	Frequency: 2 to 1000 MHz in three bands Power: 0 to 1000 watts in seven ranges Accuracy: ±5% of full scale
VHF Signal Generator, MIL-G-38712	Frequency range: 10 to 480 MHz Dial calibration accuracy: ±1% Output level: 0.1 μV to 1 V into 50 ohms Output voltage accuracy: ±1 dB into 50 ohms
Spectrum Analyzer, AN/USM-259	Distortion measurement range: Any fundamental frequency, 5 Hz to 600 kHz. Distortion levels of 0.1% to 100% are measured full scale in seven ranges. Fundamental input: Greater than 30 V Fundamental rejection: Greater than 80 dB Voltmeter range: 300 μV to 300 V full scale
Radio Receiver, Collins 51S-1	Frequency range: 2 to 30 MHz Type of reception: Usb or lsb, am or cw Rf input impedance: 50 ohms unbalanced See T.O. 31R2-4-194-1
Q Meter, Boonton 260A	Rf range: 50 kHz to 50 MHz Rf accuracy: ±1% Rf calibration: Increments of 1% Q range: 10 to 625 Q accuracy: ±5%, 50 kHz to 30 MHz
Electronic Circuit Plug-In Unit Test Set TS-3356/TSC-60(V) (975K-2 Power Amplifier Test Set)	Custom-built test set for testing selected AN/TSC-60(V) equipments. See T.O. 33A1-2-197-2.
Electrical Dummy Load DA-652/TSC-60(V) (172H-8A Electrical Dummy Load)	Simulates the impedance of a long-wire antenna for testing Antenna Coupler CU-1896/TSC-60(V)1 See T.O. 33D7-8-83-2.

Myriad XK ← Add to Supp D → Portable T.C. Terminal

309H-1 Antenna Coupler Control (Deleted)

490X-1 Antenna Coupler (Deleted)

Antenna Position Simulator
SM-685/TSC-60(V) (172Q-1
Antenna Simulator) (Deleted)

Antenna System Test Set AN/TSM-130 (Deleted)
(980H-13 Antenna Coupler Test Set)
Consisting of:
Test Set Case CY-7354/T (Deleted)
Antenna System Test Set TS-3361/T (Deleted)
Antenna Coupler Control Test Set (Deleted)
TS-3362/T
Test Set Case CY-7357/T (Deleted)
Discriminator Test Set TS-3363/T (Deleted)

Table 2-1. Test Equipment Authorized for Special Maintenance (Cont)

TEST EQUIPMENT	CHARACTERISTIC
309H-1 Antenna Coupler Control	See T.O. 31S1-2TSC60-32.
490X-1 Antenna Coupler	See T.O. 31S1-2TSC60-32.
Antenna Position Simulator SM-685/TSC-60(V) (172Q-1 Antenna Simulator)	A custom-built test set for the transmit orthogonal antenna. See T.O. 33D7-8-86-2.
Antenna System Test Set AN/TSM-129 (980H-12 Antenna Coupler Test Set) Consisting of: Test Set Case CY-7335/T Power Supply Test Set TS-3358/T Amplifier Test Set TS-3359/T Capacitor-Coil Test Set TS-3360/T Power Distribution Panel SB-3722/T Test Set Case CY-7356/T Discriminator Simulator SM-686/T	Custom-built test set for Antenna Coupler CU-1896/ TSC-60(V)1. See T.O. 33AA40-3-2.
Antenna System Test Set AN/TSM-130 (980H-13 Antenna Coupler Test Set) Consisting of: Test Set Case CY-7354/T Antenna System Test Set TS-3361/T Antenna Coupler Control Test Set TS-3362/T Test Set Case CY-7357/T Discriminator Test Set TS-3363/T	Custom-built test set for 490X-1 Antenna Coupler and 309H-1 Antenna Coupler Control. See T.O. 33AA40-3-12.
Automatic Test System, HP-9500D-224	Computer-controlled test system programmed to test selected circuit cards of the AN/TSC-60(V).
Communication Central Training Set AN/TSC-60(V)1-T2 (AN/TSC-60(V) Hot Mockup)	A complete AN/TSC-60(V) mounted in equipment racks instead of a shelter to facilitate checking individual equipments indoors.
Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V) (TE-899 Card Repair Test Set for AN/UCC-3)	Custom-built test set for AN/UCC-3(V). See T.O. 33D7-76-33-2.
Electrical Dummy load DA-653/TSC-60(V) (172S-1 Power Supply Variable Load)	Custom-built test set for Power Supply PP-4992/ARC-132. See T.O. 33AA17-120-2.

Table 2-1. Test Equipment Authroized for Special Maintenance (Cont)

TEST EQUIPMENT	CHARACTERISTIC
Electrical Special Purpose Cable Assembly CX-12964/TSC-60(V) (Maintenance Display Extender Cable)	Permits Indicator Panel SB-3390/TSC-60(V) to be extended from Communicattion Central Training Set AN/TSC-60(V)1-T2 for troubleshooting, testing and repair.
Electrical Special Purpose Cable Assembly CX-12965/TSC-60(V) (Transmit and Receive Control Head Extender Cable) 2 required	Permits Transmitter Control C-8363/TSC-60(V) and Receiver Control C-8362/TSC-60(V) to be extended from Control-Monitor OK-145/TSC-60(V) while it is installed in Communication Central Training Set AN/TSC-60(V)1-T2.
Frequency Standard O-1612/URC (AFS-81 Rubidium Frequency Standard)	Output signals: Frequency: 5 MHz, 1 MHz, 100 kHz, 1 p/s, and 1 p/m Sine-wave amplitude: 1.0 to 1.5 V rms Time-pulse amplitude: +5 to +10 V Impedance: 50 ohms Time base: A1 or UT, selectable Frequency stability: Long term: 1.5 x 10^{11} per month Short term: 2.2 x 10^{12} for 10 seconds
648A-1P Test Cover for A2 Module	Local fabrication. See figure 2-32
Neutralizing Detector for 648A-1P	Local fabrication. See figure 2-34
Crank (CPN 790-2240-001)	Used for mechanical alignment of 490X-1 Antenna Coupler
Capacitor, 500 V dc, 100 pF CC33SH101J	Used to extend range of Boonton 260A.
Gram Gauges (George Scheer Co. or equivalent)	One gauge for measuring 0 to 15 grams and one gauge for measuring 10 to 100 grams. Required for maintenance of Antenna Coupler CU-1896/TSC-60(V)1
Power Supply PP-6542/TSC-60(V)	See T.O. 31R2-2TSC60-62.
Control-Monitor C-8376/TSC-60(V) (915X-1)	See T.O. 31S1-2TSC60-102.
Amplifier Control C-8365/TSC-60(V) (915V-1)	See T.O. 31R2-2TSC60-12.
Amplifier Control C-8366/TSC-60(V) (915V-2)	See T.O. 31R2-2TSC60-22
Digital-to-Analog Converter CV-2674/SC-60(V) (309F-1)	See T.O. 31S1-2SC60-22

Table 2-1. Test Equipment Authorized for Special Maintenance (Cont)

TEST EQUIPMENT	CHARACTERISTIC
Electronic Control Amplifier AM-6229/TSC-60(V) (333H-2)	See T.O. 31R2-2TSC60-2
Electronic Test Extender Card MX-9441/TSC-60(V)	Extends cards A1 and A2 of Test Set TS-2915/UCC-3 for access to test points.
Oscillator, Hewlett-Packard 209A	Frequency: 4 Hz to 2 MHz Dial Accuracy: ±3% of frequency setting Output Voltage: 5 V rms (40 mW) into 600 ohms Output Impedance: 600 ohms
Wattmeter, Bird Model 4717 Detecting Element Part No. 5000H1 " " " 10KH1 " " " 25KH1	

2. On maintenance display unit 1A10, set POWER ON/OFF switch to OFF.

3. On monitor/switching panel 1A14, set RADIO CONTROL SELECT switch to 1/LCL.

4. Use Test Leads CX-12777/TSC-60(V) to connect the two 7404A-1 Source Generator Display units to the CCCS bus as follows:

(a) Attach the multiple pin connector on the two test leads to the DCU/DCFE SINE WAVE jack on the rear of the two 7404A-1 Source Generator Display Units.

(b) Patch the CLOCK, CONTROL, and MONITOR plugs of one test lead to MAINT DISPLAY CLOCK, CONT, and MON jacks 1A5J143 through 1A5J145.

(c) Patch the CLOCK, CONTROL, and MONITOR plugs of the other test lead to MONITOR/SWITCHING CLOCK, CONT, and MON jacks 1A5J114 through 1A5J116.

NOTE

In the following steps, the 7404A-1 connected to jacks 1A5J114 through 1A5J116 is referred to as 7404A-1 (A) and the 7404A-1 connected to jacks 1A5J143 through 1A5J145 is referred to as 7404A-1(B).

5. Set controls on both 7404A-1's as follows:

SINE WAVE/LOGIC LEVEL to SINE WAVE

DCFE DCU/LCU/LCU DCU to DCFE DCU

PARITY ENCODE to AUTO

RETRANSMIT to CONTINUAL

PARITY MODE to COMPARED

MODE to FDX

ADDRESS LENGTH to 7 BIT

6. Connect the two 7404A-1's to 120-volt ac power and set the POWER ON/OFF switches to ON. Set bit selector switch 0 (dialogic bit) on each unit to 1 (up position).

7. On 7404A-1 (A), set address bit switches 1 through 7 to 1-0-1-0-0-1-0. Randomly set bit switches 9 through 31 to 1's or 0's.

8. On 7404A-1 (B), set address bit switches 1 through 7 to 1-0-1-1-0-1-0. Set bit switches 8 through 31 to 0.

9. On the transmit control head, set the 1-kHz and the 0.1-kHz thumbwheels of the FREQUENCY-MHZ switch to 0-8. Press and release the INITIATE switch.

10. Observe that the monitor word [set by bit switches 9 through 31 on 7404A-1 (A)] is displayed on the bit indicators of 7404A-1 (B).

11. Randomly change bit switches 9 through 31 on 7404A-1 (A). On 7404A-1 (B), set address bit switches 1 through 7 to 1-0-1-1-1-1-0.

12. On the transmit control head, press and release the INITIATE switch.

13. Observe that the monitor word [set by bit switches 9 through 31 on 7404A-1 (A)] is displayed on the bit indicators of 7404A-1 (B).

14. On 7404A-1 (A), randomly change bit switches 9 through 31 and set address bit switches 1 through 7 to 1-1-1-0-0-1-0.

15. On 7404A-1 (B), set address bit switches 1 through 7 to 1-1-1-1-0-1-0.

16. On the transmit control head, press and release the INITIATE switch.

17. Observe that the monitor word [set by bit switches 9 through 31 on 7404A-1 (A)] is displayed on the bit indicators of 7404A-1 (B).

18. Randomly change bit switches 9 through 31 on 7404A-1 (A). On 7404A-1 (B), set address bit switches 1 through 7 to 1-1-1-1-1-1-0.

19. On the transmit control head, press and release the INITIATE switch.

20. Observe that the monitor word [set by bit switches 9 through 31 on 7404A-1 (A)] is displayed on the bit indicators of 7404A-1 (B).

21. On 7404A-1 (A), randomly change bit switches 9 through 31 and set address bit switches 1 through 7 to 0-0-1-0-0-1-0.

22. On 7404A-1 (B), set address bit switches 1 through 7 to 0-1-0-0-0-1-0.

23. On the transmit control head, press and release the INITIATE switch.

24. Observe that the monitor word [set by bit switches 9 through 31 o n 7404A-1 (A)] is displayed on the bit indicators of 7404A-1 (B).

25. Randomly change bit switches 9 through 31 on 7404A-1 (A). On 7404A-1 (B), set address bit switches 1 through 7 to 0-1-0-1-1-1-0.

26. On the transmit control head, press and release the INITIATE switch.

27. Observe that the monitor word [set by bit switches 9 through 31 on 7404A-1 (A)] is displayed on the bit indicators of 7404A-1 (B).

b. Initiate subtest 0-9 as follows:

1. Disconnect 7404A-1 (A) from jacks 1A5J114 through 1A5J116.

2. On maintenance display unit 1A10, set POWER ON/OFF switch to ON.

3. On monitor/switching panel 1A14, set RADIO CONTROL SELECT switch to REMOTE.

4. On the transmit control head, set the 1 kHz and the 0.1-kHz thumbwheels of the FREQUENCY-MHZ switch to 0-9. Press and release the INITIATE switch.

5. Observe that MONITOR DATA indicators 1, 9, 17, and 21 on maintenance display unit 1A10 light. All other MONITOR DATA indicators are out.

6. On the transmit control head, presets and release the INITIATE switch.

7. Observe that MONITOR DATA indicators 1 through 24 on maintenance display unit 1A10 are out.

NOTE

When subtest 0-9 follows subtest 0-7, a monitor word is observed on the maintenance display unit. Refer to T.O. 31S1-2TSC60-2 or T.O. 31S1-2TSC60-12 for details.

c. Refer to T.O. 31S1-2TSC60-2 or T.O. 31S1-2TSC60-12 and perform subtests 1-0 and 2-0.

2-5. AN/UCC-3(V) FSK CHANNEL UNIT.

2-6. The following paragraphs provide procedures for performance testing and (where required) adjusting each of the circuit cards contained on the fsk channel unit. These procedures require the use of special test equipment which is normally available only at the depot level of maintenance.

2-7. FSK TRANSMIT CIRCUIT CARD PERFORMANCE TEST. Table 2-2 contains the procedures for performance testing the fsk transmit circuit cards. Table 2-3 contains characteristics for each of the fsk transmit circuit cards. Perform all steps in table 2-2 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the circuit card is considered to be operational. If the circuit card fails to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

2-8. FSK TRANSMIT CIRCUIT CARD ADJUSTMENT PROCEDURES. The fsk transmit bandpass filter consists of four cascade twin-tee filter stages with two feed-forward paths. The adjustment consists of resistor trimming in the null and feedback networks of each filter stage to produce the proper gain and frequency response. The overall bandpass characteristics of the fsk transmit circuit card are shown in figure 2-1. The adjustment procedure is normally required after replacement of the operational amplifier in the associated stage. These procedures require the removal and replacement of components on the circuit card. Therefore, it is recommended that the procedures in table 2-2 be performed first in order to determine the requirement for adjustment. A typical active filter stage is shown in figure 2-2. Since all the fsk transmit filter stages are of the same configuration, the tuning procedure is applicable to all the fsk transmit filter stages.

a. Refer to table 2-4 to determine the reference designation for the tuning resistors (referred to throughout these procedures as resistor RA and RB) of the stage to be adjusted. Refer to figure 2-3 for the physical location of these resistors on the circuit card. Remove the resistors from the circuit by clipping them as close as possible to the body of the resistor. The leads that are left on the circuit card by clipping out the resistors shall be used to attach the RA and RB TUNING potentiometers on the TS-3357/TSC-60(V) test set. Remove the postcoating from these leads to ensure electrical connection.

b. Set up the test equipment as shown in figure 2-4.

c. Set up the TS-3357/TSC-60(V) test set as follows:

1. Press the PWR indicator-switch to turn the test set power off.

2. Install the fsk transmit circuit card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws.

3. Connect a set of test leads from jacks 1 and 2 of the RA TUNING potentiometer on the test set to the leads of the RA resistor (labled 1 and 2 respectively in figure 2-3) removed from the circuit card in step a.

4. Connect a set of test leads from jacks 1 and 2 of the RB TUNING potentiometer on the test set to the leads of the RB resistor (labled 1 and 2 respectively in figure 2-3) removed from the circuit card in step a.

5. Connect a test lead from the TUNING INPUT NODE jack on the test set to the tuning input node junction on the circuit card (refer to figure 2-3 and table 2-4).

6. The part number for the fsk transmit circuit card is stamped on the noncomponent side of the circuit card. The adjustment parameters differ for each part number. Locate the adjustment data for th associated part number in table 2-5 then adjust the TUNING INPUT potentiometer to the value specified by the R_{IN} column.

8. Set the dials of the RA and RB TUNING potentiometers to indicate 1500 ohms.

9. Set the INTERNAL VFTG OSC switch to OFF.

10. Set the INHB switch to TX in order to disable the fsk output on the circuit card.

11. Press the PWR indicator-switch on the test set to turn power on.

d. Adjust the HP-204C audio oscillator to the stage center frequency specified in table 2-5 by the F_O column (monitor the frequency with the HP-5245L frequency counter).

e. Set the HP-204C output level for 0 dB (monitored by the HP-410C at the TS-2915/UCC-3(V) ATTENUATION INPUT jack).

f. Set the 454 oscilloscope for horizontal input operation and adjust for six to eight divisions of horizontal deflection. Set the vertical attenuation for 0.5 volt/cm sensitivity.

g. Set the ATTENUATION control on the TS-2915/UCC-3(V) test set as specified for the stage in table 2-5 by the INPUT ATTENUATION column.

h. Observe the 454 trace, which should be a circular pattern. Adjust the RB TUNING potentiometer on the TS-3357/TSC-60(V) test set to narrow the pattern to a single diagonal line.

NOTE

Occasionally the RA or RB potentiometer may be adjusted to its minimum or maximum range without obtaining the indication required in steps h. and i. In these cases, move the test lead from jack 1 of the affected potentiometer to the 10K or 20K jack.

i. On the HP-410C connected to the TUNING OUT jack of the TS-3357/TSC-60(V) test set, set the range switch to 0 dB. Then adjust the RA TUNING potentiometer on the TS-3357/TSC-60(V) to obtain the indication on this HP-410C specified by the OUTPUT (dB) column of table 2-5.

j. The adjustments in steps h. and i. interact. Repeat steps h. and i. until the requirements of both steps are obtained simultaneously.

k. Record the values indicated by the dials of the RA and RB TUNING potentiometers.

l. Refer to the resistor chart in the illustrated parts breakdown of T.O. 31W2-4-196-2. From this chart, select the resistance values closest to the RA and RB TUNING potentiometer values recorded in step k.

m. Set the RA and RB TUNING potentiometers to the exact resistor values selected in step 1.

n. Adjust the output frequency of the HP-204C as required to obtain the single diagonal line on the 454 specified in step h. If the output frequency, as indicated by the HP-4245L, is within ± 3.0 Hz of the filter stage center frequency (step d.) and the output level on the HP-410C is within ± 0.2 dB (step i.), the stage is properly adjusted and the resistors selected in step l. are to be installed.

This space is left blank intentionally.

Table 2-2. FSK Transmit Circuit Card Performance Test

TEST EQUIPMENT REQUIRED:

Audio Oscillator, HP-204C
True-RMS Voltmeter, HP-3400A
Electronic Frequency Counter, HP-5245L
Oscilloscope, Tektronix 454
Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V)

PRELIMINARY INSTRUCTIONS:

Whenever the circuit card fails to meet any portion of the performance test, refer to T.O. 31W2-4-196-2 for the schematic diagram and the test point data contained there; then use standard troubleshooting techniques to locate the faulty component.

Before probing any test points or before soldering or unsoldering any connections, the postcoating applied to the circuit card must be removed from the point where the work is to be performed. For the location of test points on the fsk transmit circuit card, refer to T.O. 31W2-4-196-2.

Whenever an operational amplifier or any component in the bandpass filter networks that affects the tuning of the bandpass filter is replaced, the adjustment procedures for the circuit card are to be performed. Always check to be sure that power on the test set is turned off before installing or removing the circuit card in the test connector.

Compare the part number stamped on the noncomponent side of the fsk transmit circuit card with the informmation contained in table 2-3. The circuit card will not operate properly unless the correct crystals are installed and the frequency divider and hi-low frequency mark strapping are implemented as specified.

NOTE

Throughout these procedures, the crystal frequencies shall be referred to as F_X and the channel center frequencies shall be referred to as F_O . Refer to table 2-3 to determine the specific frequency.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	OSCILLATOR TEST	U1		
1	Set up the TS-3357/ TSC-60(V) test set as follows: Press the PWR indicator-switch to turn power off. Install the fsk transmit card in the test connector. Secure the circuit card to the guide posts			

Table 2-2. FSK Transmit Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	using two 2-56 x 1/4 panhead screws. Press the PWR indicator-switch to turn power on.			
2	Connect the HP-5245L to TP1 on the circuit card.	TP1		The HP-5245L indicates the Y1 crystal frequency. (Refer to table 2-3).
3	Connect the HP-5245L to TP2 on the circuit card.	TP2		The HP-5245L indicates the Y2 crystal frequency. (Refer to table 2-3).
4	Connect the 454 to TP1 on the circuit card.	TP1		The 454 displays a pulse pattern that swings from 0 ±0.5 Vdc to +2 ±0.5 Vdc.
5	Connect the 454 to TP2 on the circuit card.	TP2		The 454 displays a pulse pattern that swings from 0 ±0.5 Vdc to +2 ±0.5 Vdc.
	FREQUENCY DIVIDER TEST a. Direct Data Circuits Test	U2		
6	Set up the TS-3357/TSC-60(V) test set as follows: Set the INPUT DATA switch to TX and the DATA STATE switch to SPACE. Set the FSK XMIT FILTER INPUT switch to EXT. Set the AUDIO NO 2 IN switch to TX. Set the INHB switch to OFF.			
7	Connect the HP-5245L to the output of divider logic U2.	TP7		The HP-5245L indicates the F_O space frequency, ±1.0 Hz.

Table 2-2. FSK Transmit Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
8	With the equipment set up as described in steps 6 and 7, change the DATA STATE switch to MARK.	TP7		The HP-5245L indicates the F_O mark frequency, ±1.0 Hz.
9	Connect the 454 to the AUDIO NO 2 IN jack.	P1-38		The 454 displays a square-wave pattern which swings from 0 ±0.1 Vdc to 1.0 ±0.5 Vdc.
10	On the TS-3347/TSC-60(V), set the INHB switch to TX. b. Diversity Data Circuits Test	P1-38		The pattern displayed by the 454 changes from the square-wave pattern in step 9 to a logic 1 dc level (+1.0 ±0.5 Vdc).
11	Change the switch settings on the TS-3357/TSC-60(V) test set as follows: Set the INHB switch to TX DIV CONT. Set the INPUT DATA switch to TX DIV.			
12	Connect the HP-5245L to the AUDIO NO 2 IN jack.	P1-38		The HP-5245L indicates the F_O mark frequency, ±1.0 Hz.
13	Change the DATA STATE switch to SPACE. BANDPASS FILTER TEST	P1-38		The HP-5245L indicates the F_O space frequency, ±1.0 Hz.
14	Set up TS-3357/TSC-60(V) test set as follows: Set the INHB switch to TX.			

Table 2-2. FSK Transmit Circuit Card Peformance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
14 (Cont)	Connect the HP-5245L to monitor the output frequency of the HP-204C. Connect the HP-204C to the ATTENUATION INPUT jack on the TS-2915/UCC-3(V) test set. Connect the ATTENUATION OUTPUT jack to the AUDIO NO 2 IN jack on the TS-3357/TSC-60(V). Connect the HP-3400A to the AUDIO NO 2 OUT jack. Set the AUDIO NO 2 OUT switch to TX. Set the ATTENUATION control on the TS-2915/UCC-3(V) to 20.			
15	Adjust the HP-204C to the channel center frequency (F_O) and set the audio level for an indication of -20 dB on the HP-3400A connected to the AUDIO NO. 2 OUT jack.			
16	Check the gain of the bandpass filter by momentarily connecting the HP-3400A to AUDIO NO. 2 IN jack on the TS-3357 test set. Connect the HP-3400A to the AUDIO NO 2 OUT jack at the completion of this step.			The HP-3400A indicates -27.5 dB ±1.5 dB.

Table 2-2. FSK Transmit Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
17	Repeat step 15, then adjust HP-204C to F_O -42.5 Hz.			The HP-3400A indicates -21.5 dB ±3.0 dB. Note HP-3400A indication for reference in next step.
18	Adjust the HP-204C to F_O +42.5 Hz.			The HP-3400A indicates -21.5 dB ±3.0 dB. The difference in output between steps 17 and 18 shall be no more than 1.0 dB.
19	Adjust the HP-204C to F_O +90 Hz.			The HP-3400A indicates -26.0 dB or less.
20	Adjust the HP-204C to F_O -90 Hz.			Same as step 19.
21	Adjust the HP-204C to F_O -127.5 Hz.			The HP-3400A indicates -35 dB or less.
22	Adjust the HP-204C to F_O +127.5 Hz.			Same as step 21.
23	Adjust the HP-204C to F_O +200 Hz.			Same as step 21.
24	Adjust the HP-204C to F_O -200 Hz.			Same as step 21.
25	Press PWR indicator-switch to turn the TS-3357/TSC-60(V) power off and then remove the circuit card from the test connector.			

Table 2-3. FSK Transmit Circuit Card Characteristics

COLLINS PART NUMBER	CHANNEL NO.	Y1 CRYSTAL FREQUENCY (kHz)	Y2 CRYSTAL FREQUENCY (kHz)	DIVIDER RATIO STRAP	HI-LOW MARK FREQ STRAP	CENTER FREQUENCY (F_O)	MARK FREQ (Hz)	SPACE FREQ (Hz)
773-9880-001	1	195.840 ±125.0 Hz	239.360	512	LOW	425 Hz	382.5	467.5
773-9880-002	2	282.880	326.400	512	LOW	595 Hz	552.5	637.5
773-9880-003	3	184.960	206.720	256	LOW	765 Hz	722.5	807.5
773-9880-004	4	228.480	250.240	256	LOW	935 Hz	892.5	977.5
773-9880-005	5	272.000	293.760	256	LOW	1105 Hz	1062.6	1147.5
773-9880-006	6	315.520	337.280	256	LOW	1275 Hz	1232.5	1317.5
773-9880-007	7	359.040	380.800	256	LOW	1445 Hz	1402.5	1487.5
773-9880-008	8	201.280	212.160	128	LOW	1615 Hz	1572.5	1657.5
773-9880-009	9	223.040 ±62.0 Hz	233.920	128	LOW	1785 Hz	1742.5	1827.5
773-9880-010	10	244.800	255.680	128	LOW	1955 Hz	1912.5	1997.5
773-9880-011	11	266.560	277.440	128	LOW	2125 Hz	2082.5	2167.5
773-9880-012	12	288.320	299.200	128	LOW	2295 Hz	2252.5	2337.5
773-9880-013	13	310.080	320.960	128	LOW	2465 Hz	2422.5	2507.5
773-9880-014	14	331.840	342.720	128	LOW	2635 Hz	2592.5	2677.5
773-9880-015	15	353.600	364.480	128	LOW	2805 Hz	2762.5	2847.5
773-9880-016	16	375.360	386.240	128	LOW	2975 Hz	2932.5	3017.5

Table 2-4. FSK Transmit Filter Adjustment Test Nodes

FILTER STAGE	TUNING INPUT NODE JUNCTION	RESISTOR RA REF DESIG	RESISTOR RB REF DESIG
U3	R14-C15	R19	R16
U4	R25-C18	R30	R27
U5	R37-C24	R42	R39
U6	R49-C30	R54	R51

Table 2-5. FSK Transmit Filter Adjustment Data

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)
773-9880-001 (F_O = 425 Hz)				
U3	154.3	478.2	24 dB	-0.2
U4	178.9	412.0	24 dB	-0.2
U5	129.5	556.3	28 dB	-1.8
U6	202.6	354.0	28 dB	-1.8
773-9880-002 (F_O = 595 Hz)				
U3	111.5	643.0	28 dB	-1.7
U4	124.8	573.3	28 dB	-1.7
U5	97.5	721.9	30 dB	-1.4
U6	137.4	509.2	30 dB	-1.4
773-9880-003 (F_O = 765 Hz)				
U3	87.2	810.4	30 dB	-1.7
U4	95.5	739.1	30 dB	-1.7
U5	78.2	889.0	32 dB	-1.5
U6	103.3	672.5	32 dB	-1.5
773-9880-004 (F_O = 935 Hz)				
U3	71.4	978.0	30 dB	-0.1
U4	77.1	906.2	30 dB	-0.1
U5	65.2	1057.0	34 dB	-1.9
U6	82.3	837.5	34 dB	-1.9

Table 2-5. FSK Transmit Filter Adjustment Data (Cont)

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)
773-9880-005 (F_O = 1105 Hz)				
U3	60.5	1146.0	32 dB	-0.5
U4	64.7	1074.2	32 dB	-0.5
U5	55.9	1225.0	34 dB	-0.3
U6	68.5	1005.0	34 dB	-0.3
773-9880-006 (F_O = 1275 Hz)				
U3	52.5	1315.0	34 dB	-1.4
U4	55.6	1242.2	34 dB	-1.4
U5	49.0	1394.0	36 dB	-1.2
U6	58.4	1172.8	36 dB	-1.2
773-9880-007 (F_O = 1445 Hz)				
U3	46.3	1483.4	34 dB	-0.2
U4	48.7	1410.8	34 dB	-0.2
U5	43.5	1562.2	36 dB	-0.1
U6	51.0	1340.5	36 dB	-0.1
773-9880-008 (F_O = 1615 Hz)				
U3	41.4	1652.3	36 dB	-1.2
U4	43.4	1579.8	36 dB	-1.2
U5	39.2	1731.0	38 dB	-1.1
U6	45.1	1508.6	38 dB	-1.1

Table 2-5. FSK Transmit Filter Adjustment Data (Cont)

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)
773-9880-009 (F_O = 1785 Hz)				
U3	37.5	18.22.2	36 dB	-0.3
U4	39.1	1749.0	36 dB	-0.3
U5	35.6	1900.0	38 dB	-0.3
U6	40.5	1676.8	38 dB	-0.3
773-9880-010 (F_O = 1955 Hz)				
U3	34.2	1991.5	38 dB	-1.6
U4	35.5	1918.4	38 dB	-1.6
U5	32.6	2069.7	40 dB	-1.5
U6	36.7	1846.1	40 dB	-1.5
773-9880-011 (F_O = 2125 Hz)				
U3	31.4	2160.9	38 dB	-0.8
U4	32.6	2088.0	38 dB	-0.8
U5	30.1	2239.0	40 dB	-0.8
U6	33.6	2015.2	40 dB	-0.8
773-9880-012 (F_O = 2295 Hz)				
U3	29.1	2330.1	38 dB	-0.2
U4	30.1	2257.2	38 dB	-0.2
U5	28.0	2407.9	40 dB	-0.1
U6	30.9	2184.4	40 dB	-0.1

Table 2-5. FSK Transmit Filter Adjustment Data (Cont)

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)
773-9880-013 (F_O = 2465 Hz)				
U3	27.1	2499.9	40 dB	-1.5
U4	27.9	2426.9	40 dB	-1.5
U5	26.1	2377.5	42 dB	-1.5
U6	28.7	2354.0	42 dB	-1.5
773-9880-014 (F_O = 2635 Hz)				
U3	25.3	2669.5	40 dB	-0.9
U4	26.1	2596.5	40 dB	-0.9
U5	24.5	~~2747.0~~ 2577.5	42 dB	-0.9
U6	26.7	2523.4	42 dB	-0.9
773-9880-015 (F_O = 2805 Hz)				
U3	23.8	2839.0	40 dB	-0.4
U4	24.4	2766.0	40 dB	-0.4
U5	23.0	2916.4	42 dB	-0.3
U6	25.0	2692.8	42 dB	-0.3
773-9880-016 (F_O = 2975 Hz)				
U3	22.4	3009.5	42 dB	-1.9
U4	23.0	2936.3	42 dB	-1.9
U5	21.8	3086.5	44 dB	-1.8
U6	23.5	2863.0	44 dB	-1.8

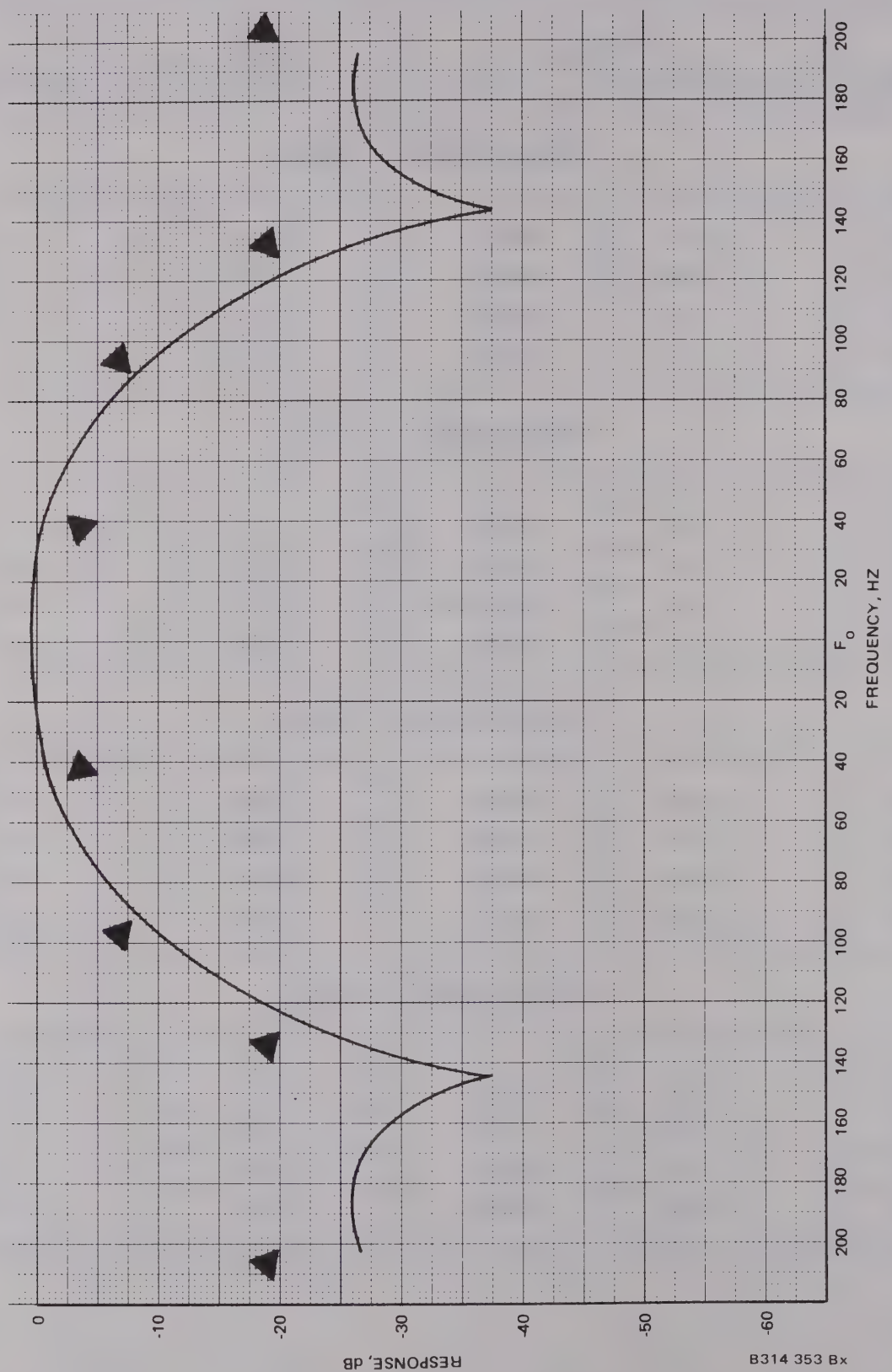


Figure 2-1. FSK Transmit Filter Bandpass Characteristics

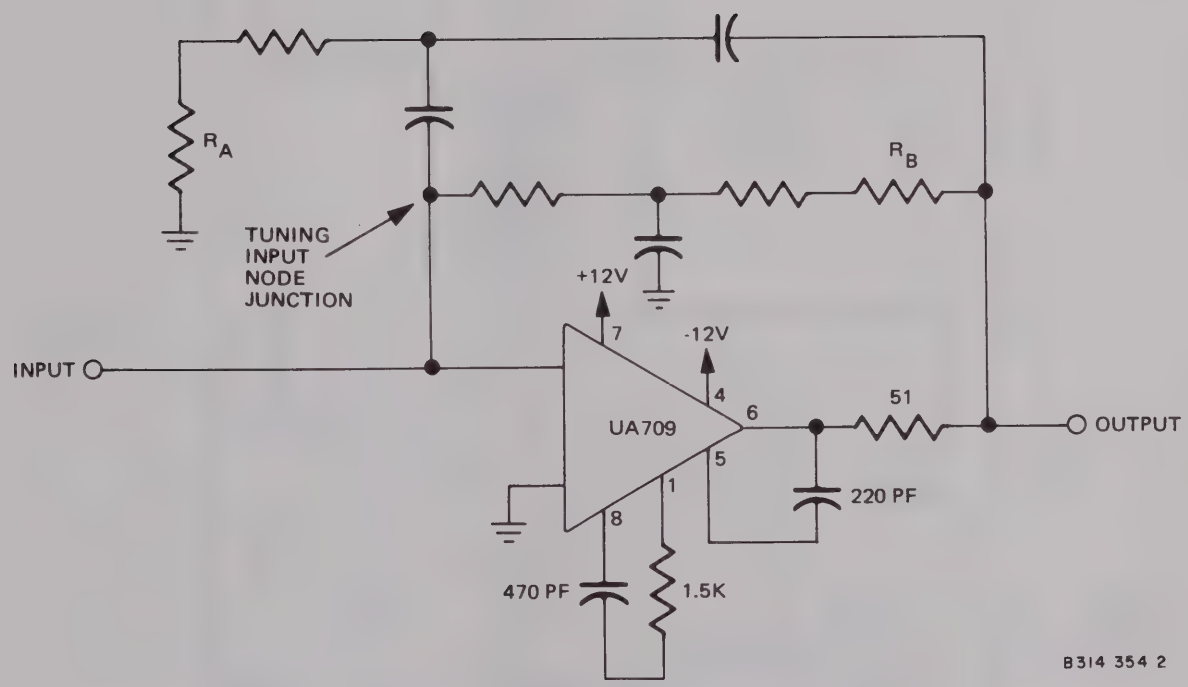


Figure 2-2. Typical FSK Active Filter Stage

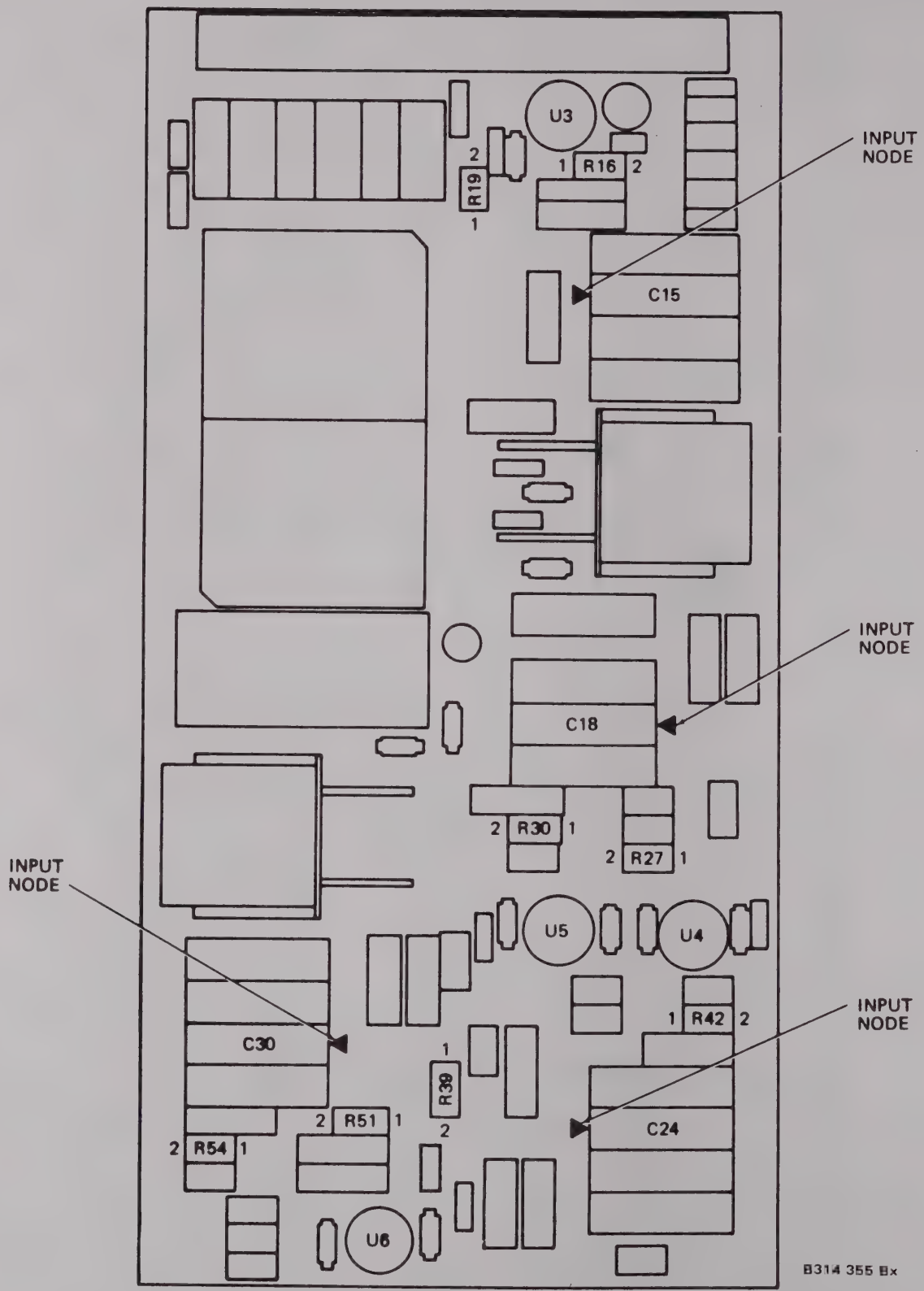


Figure 2-3. FSK Transmit Circuit Card Component Location

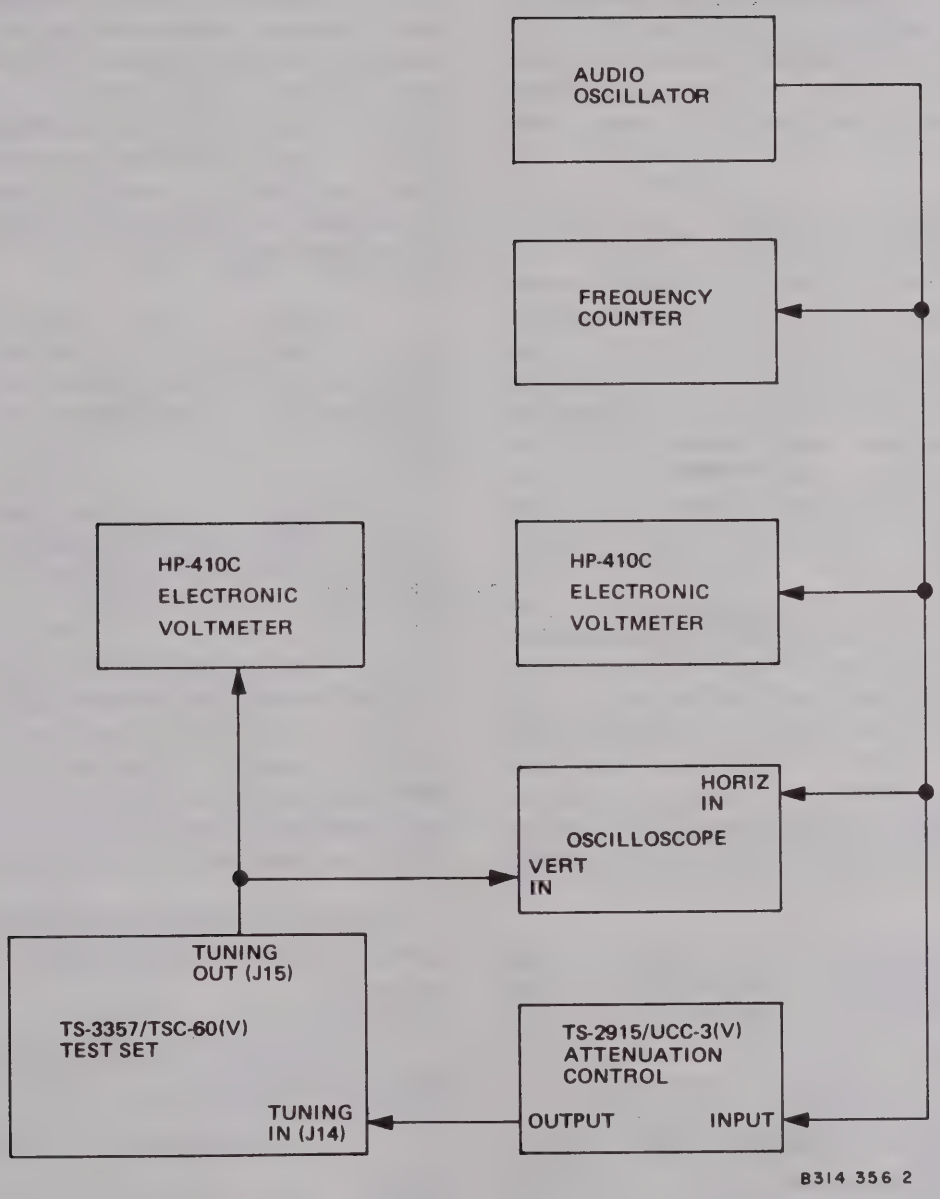


Figure 2-4. Test Setup for Filter Adjustment Procedures

2-9. FSK RECEIVE CIRCUIT CARD PERFORMANCE TEST. Table 2-6 contains the procedures for performance testing the fsk receive circuit cards. Perform all steps in table 2-6 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the circuit card is considered to be operational. If the circuit card fails to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test. Table 2-7 is a listing of the frequencies used to test the fsk receive circuit cards.

2-10. FSK RECEIVE CIRCUIT CARD ADJUSTMENT PROCEDURES. The fsk receive circuit card bandpass filter consists of six cascade twin-tee active filter stages with two feed-forward paths. The adjustment consists of resistor trimming in the null and feedback networks of each stage to produce the proper gain and frequency response. The overall bandpass characteristics for the fsk receive circuit card are shown in figure 2-5. Figure 2-6 shows the response curve for the discriminator. The adjustment procedure is normally required after replacement of the operational amplifier in the associated stage. These procedures require the removal and replacement of components on the circuit card. Therefore, it is recommended that the procedures in table 2-6 be performed first in order to determine the requirement for adjustment. A typical active filter stage is shown in figure 2-2. Because all the fsk receive filter stages are of the same configuration, the tuning procedure is applicable to all fsk receive filter stages.

a. Refer to table 2-8 , to determine the reference designation for the tuning resistors (referred to throughout these procedures as resistors RA and RB) associated with the stage to be adjusted. Refer to figure 2-7 for the physical location of these resistors on the circuit card. Remove the resistors from the stage being tuned by clipping the leads as close as possible to the body of the resistor. The leads that are left on the circuit card by clipping out the resistors shall be used to attach the RA and RB TUNING potentiometers of the TS-3357/TSC60-(V) test set. Remove the postcoating from these leads to ensure electrical connection.

b. Connect the test equipment in the test setup shown in figure 2-4.

c. Set up the TS-3357/TSC-60(V) test set as follows:

1. Press the PWR indicator-switch to turn the test set power off.

2. Install the fsk receive circuit card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws.

3. Connect a set of test leads from jacks 1 and 2 of the RA TUNING potentiometer to the leads of the RA resistor (labled 1 and 2 respectively in figure 2-7) removed from the circuit card in step a.

4. Connect a set of test leads from jacks 1 and 2 of the RB TUNING potentiometer to the leads of the RB resistor (labled 1 and 2 respectively in figure 2-7) removed from the circuit card in step a.

5. Connect a test lead from the TUNING INPUT NODE jack on the test set to the tuning input node junction on the circuit card. (Refer to figure 2-7 and table 2-8.)

6. The part number for the fsk receive circuit card is stamped on the noncomponent side of the circuit card. The adjustment parameters differ for each part number. Locate the adjustment data for the associated part number in table 2-9 ; then adjust the RC INPUT TUNING potentiometer to the value specified by the R_{IN} column.

7. Set the RC INPUT capacitance selector switch to the value specified by the C_{IN} column (table 2-9).

8. Set the RA and RB TUNING potentiometers to 1500 ohms.

9. Set the INTERNAL VFTG OSC switch to OFF.

10. Press the PWR indicator-switch to turn the test set power on.

d. Adjust each filter stage as follows:

1. Adjust the HP-204C audio oscillator to the stage center frequency specified in table 2-9 by the F_O column (monitor the frequency with the HP-5245L frequency counter).

2. Set the HP-204C output level for 0 dB (monitored by the HP-410C connected to the TS-2915/UCC-3(V) ATTENUATION INPUT jack).

3. Set the 454 oscilloscope for horizontal input operation and adjust for six to eight divisions of horizontal deflection. Set the 454 vertical attenuation for 0.5 volt/cm sensitivity.

4. Set the ATTENUATION control on the TS-2915/UCC-3(V) test set as specified for the stage in table 2-9 by the INPUT ATTENUATION column.

5. Observe the 454 trace, which should be a circular pattern. Adjust the RB TUNING potentiometer on the TS-3357/TSC-60(V) test set to narrow the 454 pattern to a single diagonal line.

6. On the HP-410C connected to the TUNING OUT jack of the TS-3357/TSC-60(V) test set, set the range switch to 0 dB. Then adjust the RA TUNING potentiometer on the TS-3357/TSC-60(V) test set to obtain the indication on this HP-410C specified by the OUTPUT (dB) column of table 2-9.

7. The adjustments in steps 5. and 6. interact. Repeat steps 5. and 6. until the requirements of both steps are obtained simultaneously.

8. Record the values indicated by the dials of the RA and RB TUNING potentiometers.

9. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2. From this chart, select the resistance value closest to the RA and RB TUNING potentiometer values recorded in step 8.

10. Set the RA and RB TUNING potentiometers to the exact resistor values selected in step 9.

11. Adjust the output frequency of the HP-204C as required to obtain the single diagonal line on the 454 specified in step 5. If the output frequency, as indicated by the HP-5245L, is within ±3.0 Hz of the filter stage center frequency (step 1) and the output level on the HP-410C is within ±0.2 dB as specified in step 6., the stage is properly adjusted and the resistors selected in step 9. are to be installed.

e. If the discriminator circuit requires adjustment, remove resistors R90 and R92 (figure 2-7) from the circuit card as described in step a.

f. Set up the TS-3357/TSC-60(V) test set as follows:

1. Press the PWR indicator-switch to turn the test set power off.

2. Install the fsk receive circuit card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws.

3. Connect a set of test leads from jacks 1 and 2 of the RA TUNING potentiometer to the leads of resistor R90.

4. Connect a set of test leads from jacks 1 and 2 of the RB TUNING potentiometer to the leads of resistor R92.

5. Set the AUDIO NO 2 IN switch to RX.

6. Connect the HP-204C, HP-5245L, and 3400A to the bunching (BB) jacks on the TS-3357/TSC-60(V).

7. Connect a test lead from the bunching jacks to the ATTENUATION INPUT jack on the TS-2915/UCC-3(V) test set.

8. Connect a test lead from the ATTENUATION OUTPUT jack of the TS-2915/UCC-3(V) to the AUDIO NO 2 IN jack of the TS-3357/TSC-60(V).

9. Connect the HP-410C to the PHASE SHIFT OUT test points on the TS-3357/TSC-60(V).

10. Connect the 8300A digital voltmeter to TP25 on the circuit card.

11. Press the PWR indicator-switch to turn the test set power on.

g. Adjust the discriminator circuit as follows:

1. Set the HP-204C frequency control to the channel center frequency of the circuit card under test (included with the associated circuit card part number in table 2-9).

2. Adjust the HP-204C output level for an indication of 0 dB on the 3400A.

3. Set the ATTENUATION control on the TS-2915/UCC-3(V) to 20 dB.

4. Adjust the RA and RB TUNING potentiometers on the TS-3357/TSC-60(V) to obtain an indication on the 8300A of +1.05 ±0.05 Vdc and a simultaneous indication on the HP-204C of +13.50 ±0.50 dB.

5. Record the values indicated by the dials of the RA and RB TUNING potentiometers.

6. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2. From this chart, select the resistance values closest to the RA and RB TUNING potentiometer values recorded in step 5.

7. Set the RA and RB TUNING potentiometers to the exact resistor values selected in step 6.

8. The 8300A should indicate +1.05 ±0.10 Vdc and the HP-410C should indicate +13.5 ±0.5 dB.

9. Change the frequency output of the HP-204C to the channel center frequency +42.5 Hz (step 1).

10. The 8300A should indicate +1.45 ±0.20 Vdc.

11. Change the frequency output of the HP-204C to the channel center frequency -42.5 Hz (step 1).

12. The 8300A should indicate +0.65 ±0.20 Vdc.

13. If the indications specified in steps 8., 10., and 12. are obtained, the discriminator stage is properly adjusted and the resistance values selected in step 6. are to be installed.

Table 2-6. FSK Receive Circuit Card Performance Test

TEST EQUIPMENT REQUIRED:

Audio Oscillator, HP-204C
True RMS Voltmeter, HP-3400A
Electronic Frequency Counter, HP-5245L
(with 5261A plug-in)
Digital Voltmeter, Fluke 8300A
Electronic Circuit Plug-In Unit Test Set
TS-3357/TSC-60(V)
Test Set TS-2915/UCC-3(V)

PRELIMINARY INSTRUCTIONS:

Whenever the circuit card fails to meet any portion of the performance test, refer to T.O. 31W2-4-196-2 for the schematic diagram and the test point data contained there; then use standard troubleshooting techniques to locate the faulty component.

Before probing any test points or before soldering or unsoldering any connections, the postcoating applied to the circuit card must be removed from the point where the work is to be performed.

When an operational amplifier or any component in the bandpass filter networks that affects the bandpass filter tuning is replaced, the adjustment procedures for the circuit card must be performed.

Always check to be sure that power is turned off on the TS-3357/TSC-60(V) test set before installing or removing a circuit card in the test connector.

NOTE

Throughout these procedures, the channel center frequency for the fsk receive circuit card shall be referred to as F_O. To determine the channel center frequency and other test frequencies, compare the part number stamped on the non-component side of the fsk receive circuit card with the information contained in table 2-7.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	RECEIVE BANDPASS FILTER TEST			
1	Set up the TS-3357/TSC-60(V) as follows: Press the PWR indicator switch to turn power off. Install the fsk receive circuit card in the test connector. Set the AUDIO NO 2 IN switch to RX. Connect the HP-5245L to monitor the output frequency of the HP-204C and connect the HP-204C to the bunching (BB) jacks.			

Table 2-6. FSK Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	Connect 600-ohm dummy load to bunching jacks. Connect the AUDIO NO 2 IN jack to the bunching jacks. Set the AUDIO NO 2 OUT switch to RX. Connect the 3400A to the AUDIO NO 2 OUT jack. Press the PWR indicator switch to turn power on.			
2	Adjust the HP-204C to the channel center frequency (F_O) as indicated on the HP-5245L. Set the audio output level for an indication of 0 dB on the HP-3400A connected to the AUDIO NO 2 OUT jack.			
3	Check the gain of the receive bandpass filter by momentarily connecting the HP-3400A to measure the output level of the HP-204C.			The HP-3400A indicates -32.5 ±4.0 dB.
4	Without disturbing the output level established in step 2, adjust the frequency of the HP-204C to F_O -42.5 Hz.			The HP-3400A (connected to AUDIO NO 2 OUT jack) indicates -3.0 ±2.0 dB. Note HP-3400 indication for reference in next step.
5	Adjust the HP-204C output frequency to F_O +42.5 Hz.			Same as step 4. The difference in output between steps 4 and 5 shall be no greater than 3.0 dB.
6	Adjust the HP-204C output frequency to F_O +80 Hz.			The HP-3400A indicates -10 dB or less.

Table 2-6. FSK Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
7	Adjust the HP-204C output frequency to F_O -80 Hz.			Same as step 6.
8	Adjust the HP-204C output frequency to F_O -105 Hz.			The HP-3400A indicates -30 dB or less.
9	Adjust the HP-204C output to F_O +105 Hz.			Same as step 8.
10	Adjust the HP-204C output to F_O +140 Hz.			The HP-3400A indicates -45 dB or less.
11	Adjust the HP-204C output to F_O -140 Hz.			Same as step 10.
	LIMITER, DISCRIMINATOR, AND POST DETECTION FILTER TEST			
12	Set up the TS-3357/TSC-60(V) test set as described in step 1, except as follows: Connect the HP-204C to the ATTENUATION INPUT jack of the TS-2915/UCC-3(V). Connect the HP-5245L to monitor the HP-204C output. Connect the 320A and the ATTENUATION OUTPUT jack of the TS-2915/UCC-3(V) to the bunching jacks. Connect the AUDIO NO 2 IN jack to the bunching jacks. Connect a 600-ohm dummy load to the bunching jacks.			

Table 2-6. FSK Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
12 (Cont)	Connect the 8300A to TP25 on the fsk receive circuit card.			
13	Adjust the HP-204C output frequency to F_O with the output level attenuated to produce an indication of -20 dB on the HP-3400A.	TP25		The 8300A connected to TP25 indicates +1.04 ±0.2 Vdc.
14	Adjust the HP-204C output frequency to F_O -42.5 Hz.	TP25		The 8300A indicates +0.65 ±0.2 Vdc.
15	Adjust the HP-204C output frequency to F_O +42.5 Hz.	TP25		The 8300A indicates +1.45 ±0.2 Vdc.
	COMPARATOR AND OUTPUT BUFFER TEST	U11, Q2, Q3		
16	Set up the TS-3357/ TSC-60(V) test set as follows:			
	Connect the HP-204C to the bunching jacks. Connect the HP-5245L to monitor the HP-204C output. Connect the AUDIO NO 2 IN jack to the bunching jacks. Connect a 600-ohm dummy load to the bunching jacks. Set the OUTPUT DATA switch to RX HI. Set the AUDIO NO 2 OUT switch to RX. Connect the 3400A to the AUDIO NO 2 OUT jack.	P1-50		

Table 2-6. FSK Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
16 (Cont)	Connect the 8300A to the OUTPUT DATA jack.			
17	Repeat steps 2 and 4.			The 8300A indicates less than +0.1 ±0.5 Vdc (space).
18	Set the OUTPUT DATA switch to RX LO.	P1-54		The 8300A indicates more than +3.5 ±1.0 Vdc (space).
19	Adjust the HP-204C output to F_O +42.5 Hz.	P1-54		The 8300A indicates less than +0.1 ±0.5 Vdc (low mark).
20	Set the OUTPUT DATA switch to RX HI.	P1-50		The 8300A indicates more than +3.5 ±1.0 Vdc (high mark).
21	End of test. Press the PWR indicator-switch to turn power off; then remove the circuit card under test.			

Table 2-7. FSK Receive Circuit Card Test Frequencies

COLLINS PART NUMBER	(F_O) CENTER FREQ	F_O -42.5	F_O +42.5	F_O -80.0	F_O +80.0	F_O -105.0	F_O +105.0	F_O -140.0	F_O +140.0
773-9882-001	425.0	382.5	467.5	345.0	505.0	320.0	530.0	285.0	565.0
773-9882-002	595.0	552.5	637.5	515.0	675.0	490.0	700.0	455.0	735.0
773-9882-003	765.0	722.5	807.5	685.0	845.0	660.0	870.0	625.0	905.0
773-9882-004	935.0	892.5	977.5	855.0	1015.0	830.0	1040.0	795.0	1075.0
773-9882-005	1105.0	1062.5	1147.5	1025.0	1185.0	1000.0	1210.0	965.0	1245.0
773-9882-006	1275.0	1232.5	1317.5	1195.0	1355.0	1170.0	1380.0	1135.0	1415.0
773-9882-007	1445.0	1402.5	1487.5	1365.0	1525.0	1340.0	1550.0	1305.0	1585.0
773-9882-008	1615.0	1572.5	1657.5	1535.0	1695.0	1510.0	1720.0	1475.0	1755.0
773-9882-009	1785.0	1742.5	1827.5	1705.0	1865.0	1680.0	1890.0	1645.0	1925.0
773-9882-010	1955.0	1912.0	1997.5	1875.0	2035.0	1850.0	2060.0	1815.0	2095.0
773-9882-011	2125.0	2082.5	2167.5	2045.0	2205.0	2020.0	2230.0	1985.0	2265.0
773-9882-012	2295.0	2252.5	2337.5	2215.0	2375.0	2190.0	2400.0	2155.0	2435.0
773-9882-013	2465.0	2422.5	2507.5	2385.0	2545.0	2360.0	2570.0	2325.0	2605.0
773-9882-014	2635.0	2592.5	2677.5	2555.0	2715.0	2530.0	2740.0	2495.0	2775.0
773-9882-015	2805.0	2762.5	2847.5	2725.0	2885.0	2700.0	2910.0	2665.0	2945.0
773-9882-016	2975.0	2932.5	3017.5	2895.0	3055.0	2870.0	3080.0	2835.0	3115.0

Table 2-8. FSK Receive Filter Adjustment Test Nodes

FILTER STAGE	TUNING INPUT NODE JUNCTION	RESISTOR RA REF DESIG	RESISTOR RB REF DESIG
U1	R7-C5	R5	R9
U2	R17-C11	R15	R19
U3	R28-C16	R33	R30
U4	R38-C21	R43	R40
U5	R52-C29	R57	R54
U6	R62-C34	R67	R64

Table 2-9. FSK Receive Filter Adjustment Data

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)	C_{IN} (pF)
773-9882-001 (F_O = 425 Hz)					
U1	186.0	353.0	38 dB	-1.4	2400
U2	128.5	507.0	38 dB	0.0	2400
U3	154.2	452.0	30 dB	-0.1	2400
U4	180.3	377.0	32 dB	-1.0	2400
U5	140.9	478.0	32 dB	-0.6	2400
U6	167.9	410.0	30 dB	-0.7	2400
773-9882-002 (F_O = 595 Hz)					
U1	127.9	531.5	42 dB	-1.2	2400
U2	97.1	683.5	42 dB	-1.2	2400
U3	111.2	619.3	34 dB	-1.3	2400
U4	124.9	554.2	36 dB	-1.9	2400
U5	104.0	654.1	36 dB	-1.9	2400
U6	118.5	585.0	34 dB	-1.3	2400
773-9882-003 (F_O = 765 Hz)					
U1	97.0	697.9	44 dB	-1.2	2400
U2	77.9	851.4	44 dB	-1.2	2400
U3	86.8	787.1	36 dB	-1.3	2400
U4	95.2	721.2	38 dB	-1.9	2400
U5	82.3	822.7	38 dB	-1.9	2400
U6	91.3	753.0	36 dB	-1.3	2400

Table 2-9. FSK Receive Filter Adjustment Data (Cont)

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)	C_{IN} (pF)
773-9882-004 (F_O = 935 Hz)					
U1	78.0	865.1	46 dB	-1.5	2400
U2	65.0	1019.6	46 dB	-1.5	2400
U3	71.1	956.6	38 dB	-1.6	2400
U4	76.8	889.0	38 dB	-0.7	2400
U5	68.0	991.6	38 dB	-0.7	2400
U6	74.1	921.4	38 dB	-1.6	2400
773-9882-005 (F_O = 1105 Hz)					
U1	65.1	1033.0	46 dB	-0.1	2400
U2	55.8	1188.1	46 dB	-0.1	2400
U3	60.2	1125.5	38 dB	-0.1	2400
U4	64.3	1057.5	40 dB	-0.13	2400
U5	58.0	1160.6	40 dB	-0.8	2400
U6	62.4	1090.3	38 dB	-0.1	2400
773-9882-006 (F_O = 1275 Hz)					
U1	55.9	1201.3	48 dB	-0.9	2400
U2	48.8	1356.5	48 dB	-0.9	2400
U3	52.2	1295.0	40 dB	-0.9	2400
U4	55.3	1226.2	40 dB	-0.6	2400
U5	50.5	1329.6	42 dB	-1.6	2400
U6	53.9	1259.1	40 dB	-0.9	2400

Table 2-9. FSK Receive Filter Adjustment Data (Cont)

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)	C_{IN} (pF)
773-9882-007 (F_O = 1445 Hz)					
U1	48.9	1370.0	46 dB	-0.1	2400
U2	43.4	1525.2	48 dB	-1.3	2400
U3	46.1	1464.4	40 dB	-0.3	2400
U4	48.4	1395.0	42 dB	-1.7	2400
U5	44.8	1498.5	42 dB	-1.3	2400
U6	47.3	1428.3	40 dB	-0.5	2400
773-9882-008 (F_O = 1615 Hz)					
U1	43.5	1538.8	48 dB	-1.1	2400
U2	39.1	1694.1	48 dB	-0.3	2400
U3	41.2	1633.6	42 dB	-1.3	2400
U4	43.1	1564.4	42 dB	-0.7	2400
U5	40.2	1667.5	42 dB	-0.3	2400
U6	42.2	1597.9	42 dB	-1.5	2400
773-9882-009 (F_O = 1785 Hz)					
U1	78.3	1707.8	42 dB	-0.2	1200
U2	71.1	1863.5	44 dB	-1.4	1200
U3	74.6	1803.1	36 dB	-0.5	1200
U4	77.7	1733.8	38 dB	-1.9	1200
U5	72.8	1836.7	38 dB	-1.5	1200
U6	76.2	1767.2	36 dB	-0.7	1200

Table 2-9. FSK Receive Filter Adjustment Data (Cont)

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)	C_{IN} (pF)
773-9882-010 (F_O = 1955 Hz)					
U1	71.3	1877.0	44 dB	-0.8	1200
U2	65.2	2032.6	46 dB	-1.6	1200
U3	68.1	1972.5	38 dB	-1.4	1200
U4	70.7	1903.2	40 dB	-1.8	1200
U5	66.6	2006.0	38 dB	0.0	1200
U6	69.5	1936.5	38 dB	-1.1	1200
773-9882-011 (F_O = 2125 Hz)					
U1	65.3	2046.5	44 dB	-0.1	1200
U2	60.2	2202.2	46 dB	-0.9	1200
U3	62.6	2142.0	38 dB	-0.7	1200
U4	64.8	2072.9	40 dB	-1.1	1200
U5	61.4	2175.5	40 dB	-1.3	1200
U6	63.8	2106.2	38 dB	-0.4	1200
773-9882-012 (F_O = 2295 Hz)					
U1	60.3	2216.2	46 dB	-1.4	1200
U2	55.9	2372.1	46 dB	-0.2	1200
U3	58.0	2311.6	38 dB	0.0	1200
U4	59.8	2242.8	40 dB	-0.4	1200
U5	56.9	2345.3	40 dB	-0.6	1200
U6	59.0	2276.2	40 dB	-1.7	1200

Table 2-9. FSK Receive Filter Adjustment Data (Cont)

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)	C_{IN} (pF)
773-9882-013 (F_O = 2465 Hz)					
U1	56.0	2386.0	46 dB	-0.5	1200
U2	52.1	2542.1	48 dB	-1.7	1200
U3	54.0	2481.5	40 dB	-1.4	1200
U4	55.6	2412.8	42 dB	-1.8	1200
U5	53.1	2515.3	40 dB	-0.3	1200
U6	54.9	2446.2	40 dB	-1.2	1200
773-9882-014 (F_O = 2635 Hz)					
U1	52.2	2555.9	48 dB	-1.9	1200
U2	48.9	2712.1	48 dB	-1.1	1200
U3	50.5	2651.5	40 dB	-0.8	1200
U4	51.9	2582.8	42 dB	-1.2	1200
U5	49.7	2685.3	42 dB	-1.7	1200
U6	51.2	2616.2	40 dB	-0.6	1200
773-9882-015 (F_O = 2805 Hz)					
U1	49.0	2725.9	48 dB	-1.4	1200
U2	46.0	2882.1	48 dB	-0.6	1200
U3	47.4	2821.5	40 dB	-0.3	1200
U4	48.7	2752.8	42 dB	-0.7	1200
U5	46.7	2855.3	42 dB	-1.2	1200
U6	48.1	2786.2	40 dB	-0.1	1200

Table 2-9. FSK Receive Filter Adjustment Data (Cont)

STAGE	R_{IN} (KILOHMS)	F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)	C_{IN} (pF)
773-9882-016 (F_O = 2975 Hz)					
U1	46.0	2895.9	48 dB	-0.8	1200
U2	43.4	3052.1	48 dB	0.0	1200
U3	44.7	2991.5	42 dB	-1.7	1200
U4	45.8	2922.8	42 dB	-0.1	1200
U5	44.1	3025.3	42 dB	-0.6	1200
U6	45.3	2956.2	42 dB	-1.5	1200

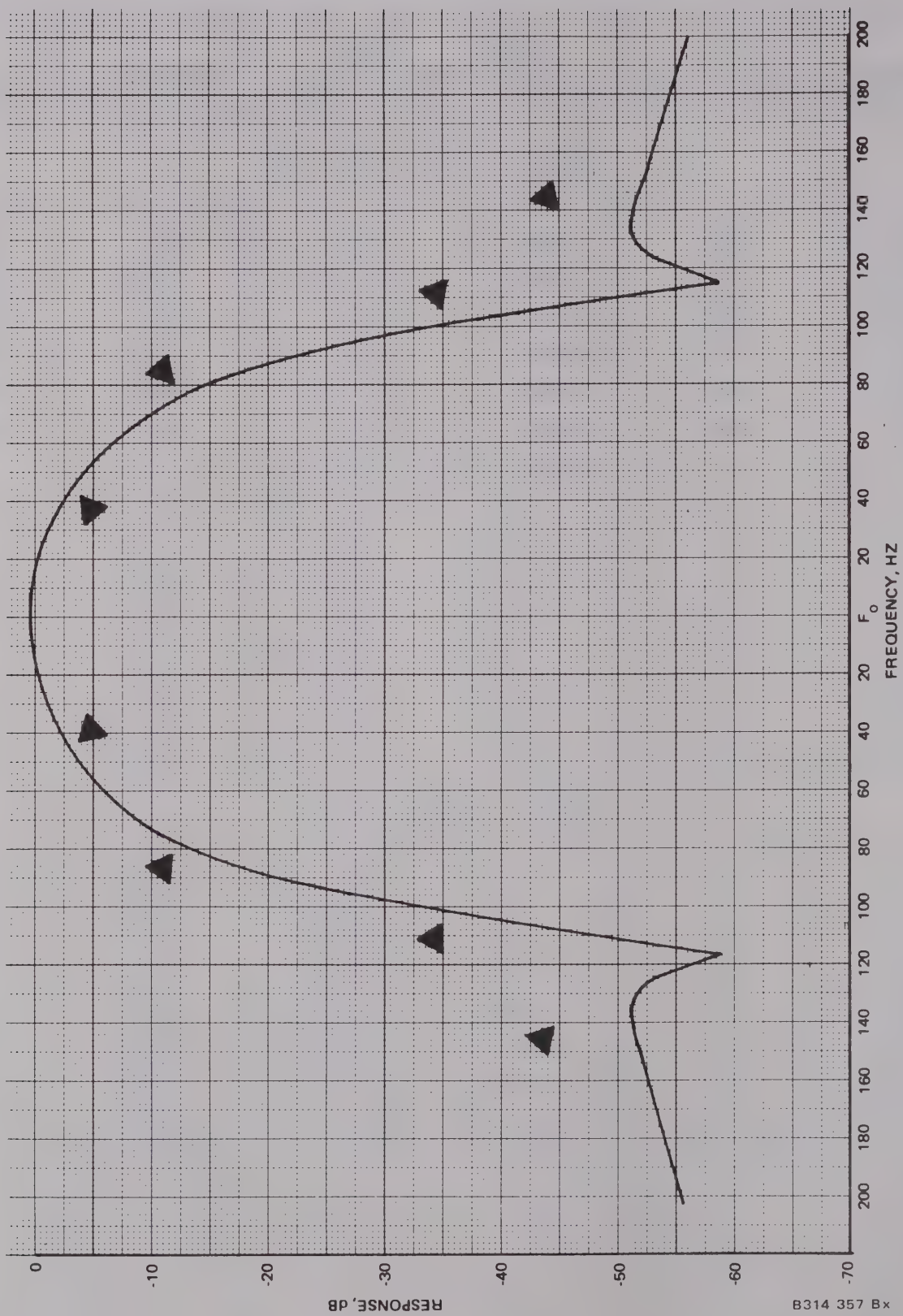


Figure 2-5. FSK Receive Filter Bandpass Characteristics

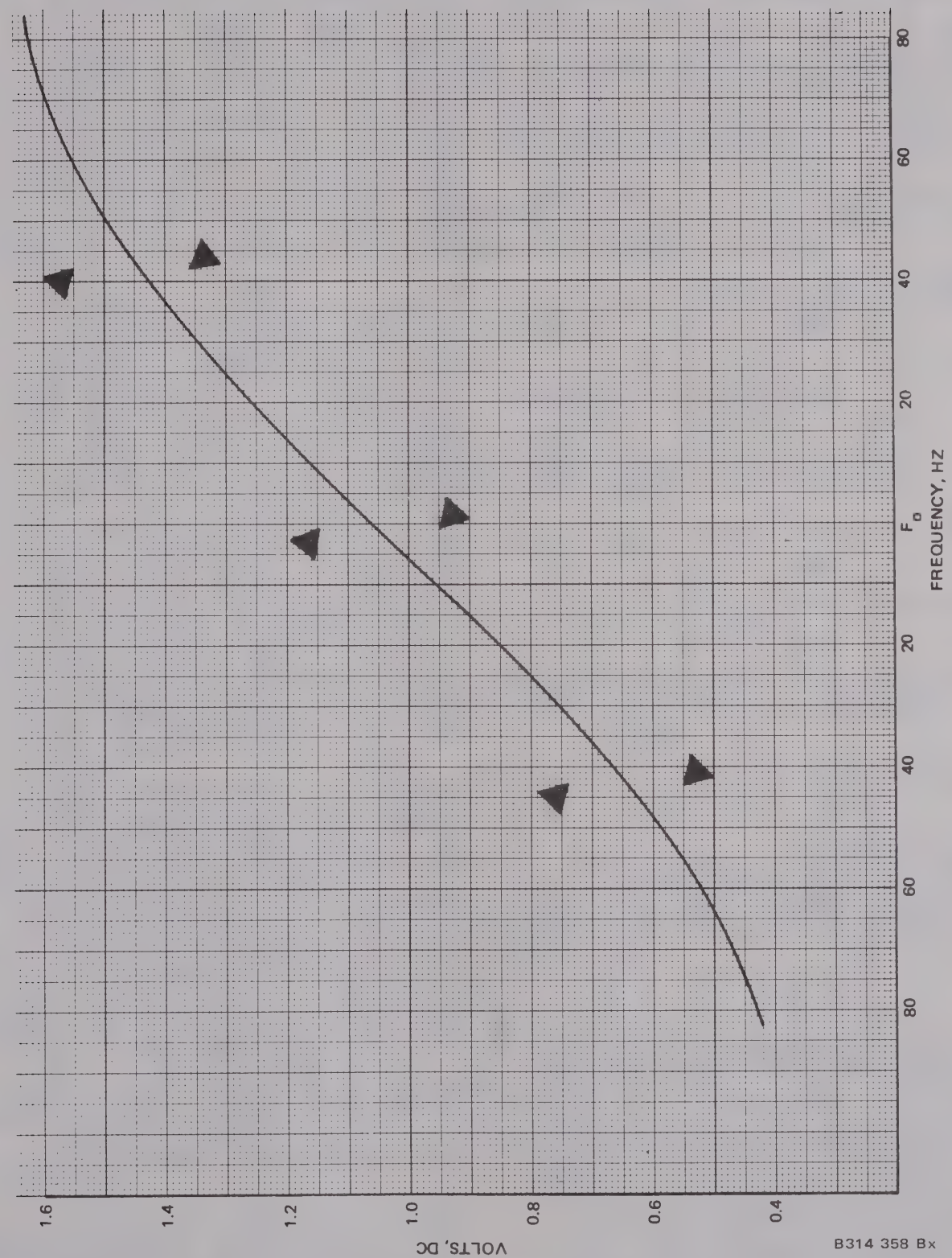


Figure 2-6. Discriminator Response Curve

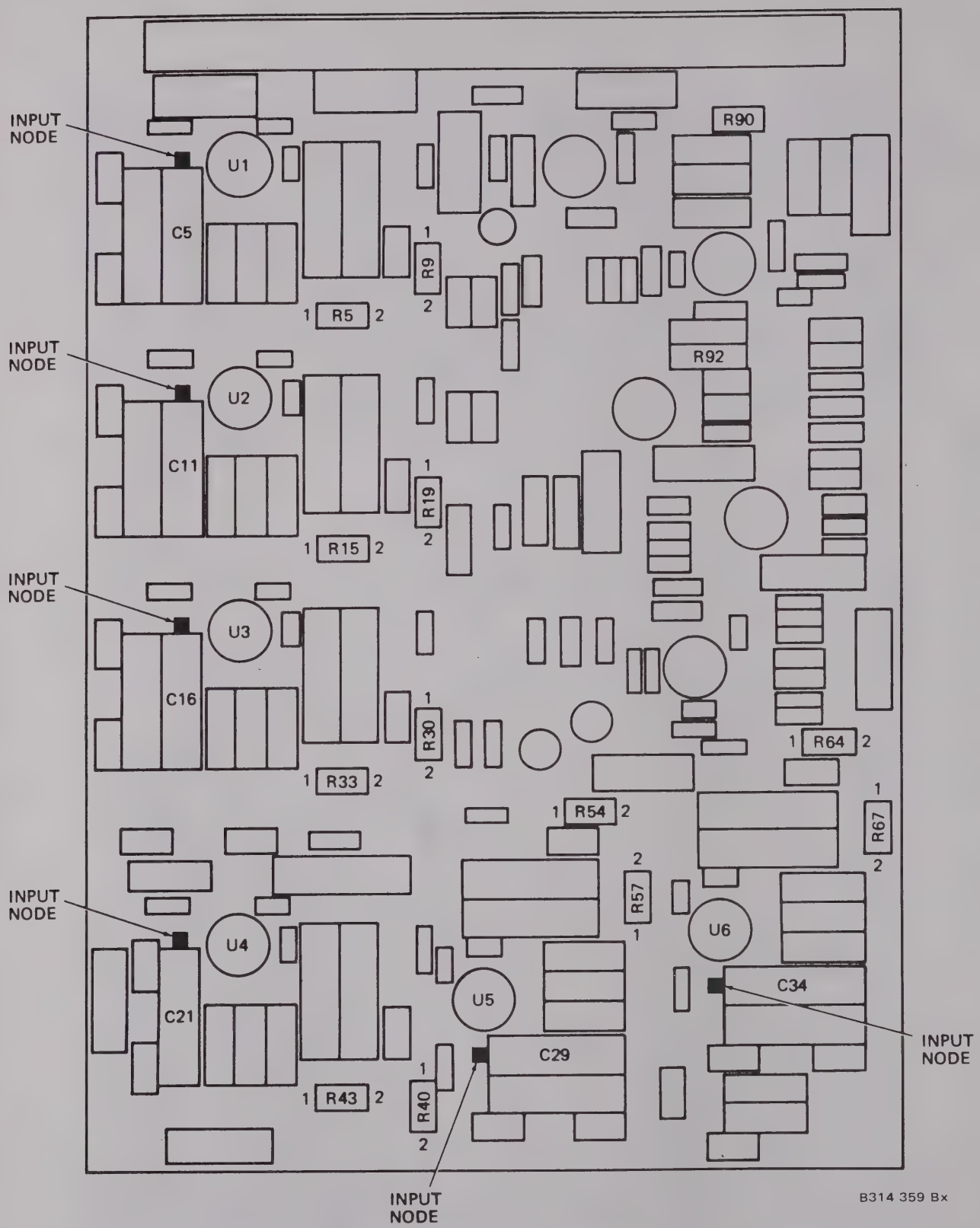


Figure 2-7. FSK Receive Circuit Card Component Location

2-11. VFTG TRANSMIT/RECEIVE CIRCUIT CARD PERFORMANCE TEST. Table 2-10 contains the procedures for performance testing the vftg transmit/receive circuit card. Perform all steps in table 2-10 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the circuit card is considered to be operational. If the circuit card fails to meet a performance standard, use standard trouble-shooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

2-12. VFTG TRANSMIT/RECEIVE CIRCUIT CARD ADJUSTMENT PROCEDURES. The receive circuits of the vftg transmit/receive circuit card contain a discriminator circuit, which consists of an active phase-shift network. The adjustment procedures consist of trimming the fixed resistor values in the phase-shift network to provide the required gain and frequency response. The adjustment procedure is normally required after replacement of the operational amplifier in the stage. Because these procedures require the removal and replacement of fixed resistance in the circuit card, it is recommended that the procedures in table 2-10 be performed first in order to determine the requirement for adjustment. The characteristics of the vftg receive filter, discriminator, and transmit filter are shown in figures 2-6, 2-8, and 2-9.

a. Remove resistors R26 and R27 from the circuit board by clipping the leads as close as possible to the resistor body. Refer to the illustrated parts breakdown in T.O. 31W2-4-196-2 for the physical location of these resistors on the circuit board. The leads that are left on the circuit board by clipping out the resistors shall be used to attach the RA and RB TUNING potentiometers of the TS-3357/TSC-60(V) test set during the tuning procedures. Remove the postcoating from these leads to ensure a proper electrical connection.

b. Press the PWR indicator-switch on the TS-3357/TSC-60(V) to turn power off.

c. Install the vftg transmit/receive circuit card in the test connector.

d. Connect a set of test leads from jacks 1 and 2 of the RA TUNING potentiometer on the TS-3357/TSC-60(V) test set to the leads of resistor R26.

e. Connect a set of test leads from jacks 1 and 2 of the RB TUNING potentiometer on the TS-3357/TSC-60(V) test set to the leads of resistor R27.

f. Connect the HP-204C audio oscillator, HP-5245L frequency counter, and 3400A rms voltmeter to the AUDIO NO. 1 IN jack on the TS-3357/TSC-60(V) through the bunching jacks.

g. Connect the HP-410C to TP1 on the circuit card. Refer to T.O. 31W2-4-196-2 for the location of test points on the circuit card.

h. Connect the 8300A digital voltmeter to TP3 on the circuit card.

i. On the TS-3357/TSC-60(V), press the PWR indicator-switch to turn power on.

j. On the TS-3357/TSC-60(V), set the INTERNAL VFTG OSC switch to OFF.

k. On the TS-3357/TSC-60(V), set the INHB switch to OFF.

l. On the TS-3357/TSC-60(V), set the AUDIO NO. 1 IN switch to VFTG.

m. Adjust the HP-204C frequency control for an indication of 1275 Hz on the HP-5245L.

n. Adjust the HP-204C output level for an indication of 0 dB on the 3400A at the bunching jacks.

o. Adjust the RA and RB TUNING potentiometers on the TS-3357/TSC-60(V) test set to obtain an indication on the 8300A of +1.05 ±0.05 Vdc and a simultaneous indication on the HP-410C of +13 ±0.5 dB.

NOTE

Occasionally the values of either or both the RA and RB TUNING potentiometers will be reduced to zero ohm while attempting to obtain the indication required by step o. In such cases, the values of resistors R25 and R28 must be decreased Select the next lower values of these resistors from the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2; then repeat the procedure.

p. Record the values indicated by the dials of the RA and RB TUNING potentiometers.

q. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2. From this chart, select the resistance values closest to the RA and RB TUNING potentiometer values recorded in step p.

r. Set the RA and RB TUNING potentiometers to the exact resistor values selected in step q.

s. The 8300A should indicate +1.05 ±0.10 Vdc. The HP-410C should indicate +13 ±1.0 dB.

t. Change the output frequency of the HP-204C to 1317.5 Hz.

u. The 8300A should indicate +1.45 ±0.20 Vdc.

v. Change the frequency output of the HP-204C to 1232.5 Hz.

w. The 8300A should indicate +0.65 ±0.20 Vdc.

x. If the indications specified in steps s., u., and w. are obtained, the discriminator stage is properly tuned and the resistance values selected in step q. are to be installed.

Table 2-10. VFTG Transmit/Receive Circuit Card Performance Test

TEST EQUIPMENT REQUIRED:

Electronic Frequency Counter, HP-5245L
Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V)
Test Set TS-2915/UCC-3(V)
Oscilloscope, Tektronix 454
Audio Oscillator, HP-204C
Digital Voltmeter, Fluke 8300A
True-RMS Voltmeter, HP-3400A
Electronic Voltmeter, HP-410C

PRELIMINARY INSTRUCTIONS:

In order to probe the test points referenced throughout these procedures, it may be necessary to remove the postcoating at the test point location on the circuit card in order to ensure electrical contact. Refer to T.O. 31W2-4-196-2 for the schematic diagram of the vftg transmit/receive circuit card and the test point locations.

Always turn power off on the TS-3357/TSC-60(V) test set before installing or removing the circuit card. If the circuit card fails to meet any portion of the performance test, refer to the schematic diagram and the test point data contained thereon, and use standard troubleshooting techniques to locate the faulty component.

Whenever an operational amplifier or any component in the bandpass filter networks that affects the bandpass tuning is replaced, the adjustment procedures for the circuit card are to be performed.

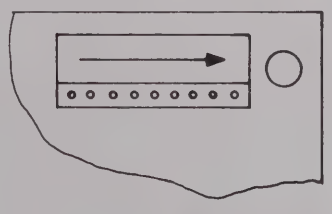
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	TRANSMIT SECTION TEST			
	A. Transmit Logic Network Test	U8		
1	Set up the TS-3357/TSC-60(V) test set as follows: Press the PWR indicator-switch to turn power off Install the vftg Transmit/receive card in the test connector. Secure the card to the guide posts with two 2-56 x 1/4 panhead screws.		Configure the strapping option on the circuit card for low-frequency transmit mark and high-frequency receive mark as shown in the following diagram. (Refer to T.O. 31W2-4-196-2.)  B537 264A Bx	

Table 2-10. VFTG Transmit/Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	Set the INTERNAL VFTG OSC switch to ON. Set the INPUT DATA switch to VFTG. Set the DATA STATE switch to MARK. Set the INHB switch to OFF. Press the PWR indicator-switch to turn power on.			
2	Connect the HP-5245L to TP4 on the circuit card.	TP4		The HP-5245L indicates 1232.5 ±0.5 Hz.
3	Set the DATA STATE switch to SPACE.	TP4		Frequency counter indicates 1317.5 ±0.5 Hz.
	B. Transmit Filter Test	U6, U7		
4	Set up the TS-3357/TSC-60(V) test set as follows: Set the AUDIO NO 1 OUT switch to VFTG. Connect a patch cable from the AUDIO NO 1 OUT jack to the bunching jacks. Connect a 600-ohm dummy load to the bunching jacks. Connect the HP-3400A and the 454 to the bunching jacks.			

Table 2-10. VFTG Transmit/Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5	Set the DATA STATE switch to MARK.		Adjust gain potentiometer R49 (20k) on the circuit card.	The HP-3400A indicates that the output level is adjustable from 0 dB to -30 dB. Readjust gain potentiometer for 0-dB output level.
6	Set DATA STATE switch to SPACE.			Output level indicated on the HP-3400A changes less than 1.0 dB from that established in step 5.
7	Set the INHB switch to VFTG.			The sine-wave pattern on the 454 changes to a dc level. The HP-3400A indicates less than -30 dB.
	RECEIVE SECTION TEST	U1, U2, U3		
	A. Receive Filter, Limiter, Discriminator Test			
8	Set up the TS-3357/TSC-60(V) follows:			
	Connect the output of the HP-204C to the ATTENUATION-INPUT jack of the TS-2915/UCC-3 test set.			
	Connect the ATTENUATION-OUTPUT jack of the TS-2915/UCC-3 test set to the bunching jacks on the TS-3357/TSC-60(V) test set.			
	Connect the HP-5245L and the HP-3400A to the bunching jacks.			
	Connect the bunching jacks to the AUDIO NO 1 IN jack.	P1-28		

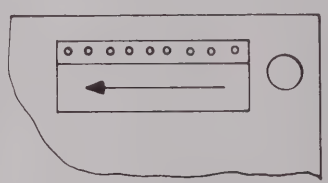
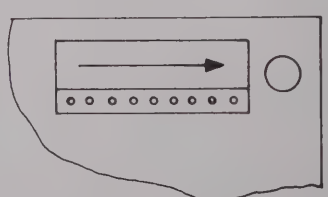
Table 2-10. VFTG Transmit/Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
8 (Cont)	Set the AUDIO NO 1 IN switch to VFTG. Connect an 8300A to TP3 on the circuit card. Set the ATTENUATION control on the TS-2915/UCC-3 test set to 0 dB.			
9	Adjust the HP-204C for an indication of 1275 Hz on the HP-5245L and set the output level for an indication of 0 dB on the HP-3400A. Connect the HP-410C to TP1 on the circuit card.	TP1, TP3		The 8300A indicates +1.05 ±0.10 Vdc. The HP-410C indicates +13 ±1.0 dB.
10	Adjust the ATTENUATION control on the TS-2915/UCC-3 test set for 40-dB attenuation.	TP3		Same as step 9.
11	Repeat step 9, with the HP-204C frequency adjusted to 1317.5 Hz and the ATTENUATION control on the TS-2915/UCC-3 test set adjusted for 0-dB attenuation.	TP3		The 8300A indicates +1.45 ±0.20 Vdc.
12	Adjust the ATTENUATION control on the TS-2915/UCC-3(V) test set to 40 dB.	TP3		The 8300A indicates +1.45 ±0.20 Vdc.
13	Repeat step 9, with the HP-204C frequency adjusted to 1232.5 Hz and the ATTENUATION control on the TS-2915/UCC-3 test set adjusted for 0-dB attenuation.	TP3		The 8300A indicates +0.65 ±0.20 Vdc.

Table 2-10. VFTG Transmit/Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
14	Adjust the ATTENUATION control on the TS-2915/UCC-3(V) test set to 40 dB. B. Comparator and Receiver Output Test.	TP3		The 8300A indicates +0.65 ±0.20 Vdc.
15	Set up the TS-3357/TSC-60(V) test set as follows: Set the INHB switch to OFF. Set the INPUT DATA switch to VFTG. Set the DATA STATE switch to SPACE. Connect the DOT GEN jack of the TS-2915/UCC-3 test set to the DIR INPUT DATA jack of the TS-3357/TSC-60(V) test set. Set the INTERNAL VFTG OSC switch to ON. Set the AUDIO NO 1 IN switch to VFTG. Set the AUDIO NO 1 OUT switch to VFTG. Connect the AUDIO NO 1 IN jack to the AUDIO NO 1 OUT jack. Set the OUTPUT DATA switch to VFTG. Connect the 454 and the 8300A to the OUTPUT DATA jack through the bunching jacks.			

Table 2-10. VFTG Transmit/Receive Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
				NOTE It may be necessary to readjust R49 before performance standards in step 16 can be met.
16	Observe the indication on the 8300A.			The 8300A indicates the high-level mark output of +2.5 ±1.5 Vdc.
17	Set the DATA STATE switch to MARK and observe the indication on the 8300A.			The 8300A indicates 0 ±0.5 Vdc.
18			Configure the strapping option on the circuit card for high-freequency transmit mark and low-frequency receive mark as shown in following diagram. (Refer to T.O. 31W2-4-196-2.)  B537 264B Bx	The 8300A indicates 0 ±0.5 Vdc.
19	Set the DATA STATE switch set to SPACE.			The 8300A indicates +2.5 ±1.5 Vdc.
20	Set the DATA STATE switch to DATA.		Configure the strapping option on the circuit card for low-frequency transmit mark and high-frequency receive mark as shown in the following diagram. (Refer to T.O. 31W2-4-196-2.)  B537 264A Bx	The 454 displays a symmetrical square wave at 37 Hz. The symmetry may be varied by adjusting R40 (BIAS ADJ) on the vftg transmit/receive circuit card. Adjust R40 (if required) for a symmetrical waveform.

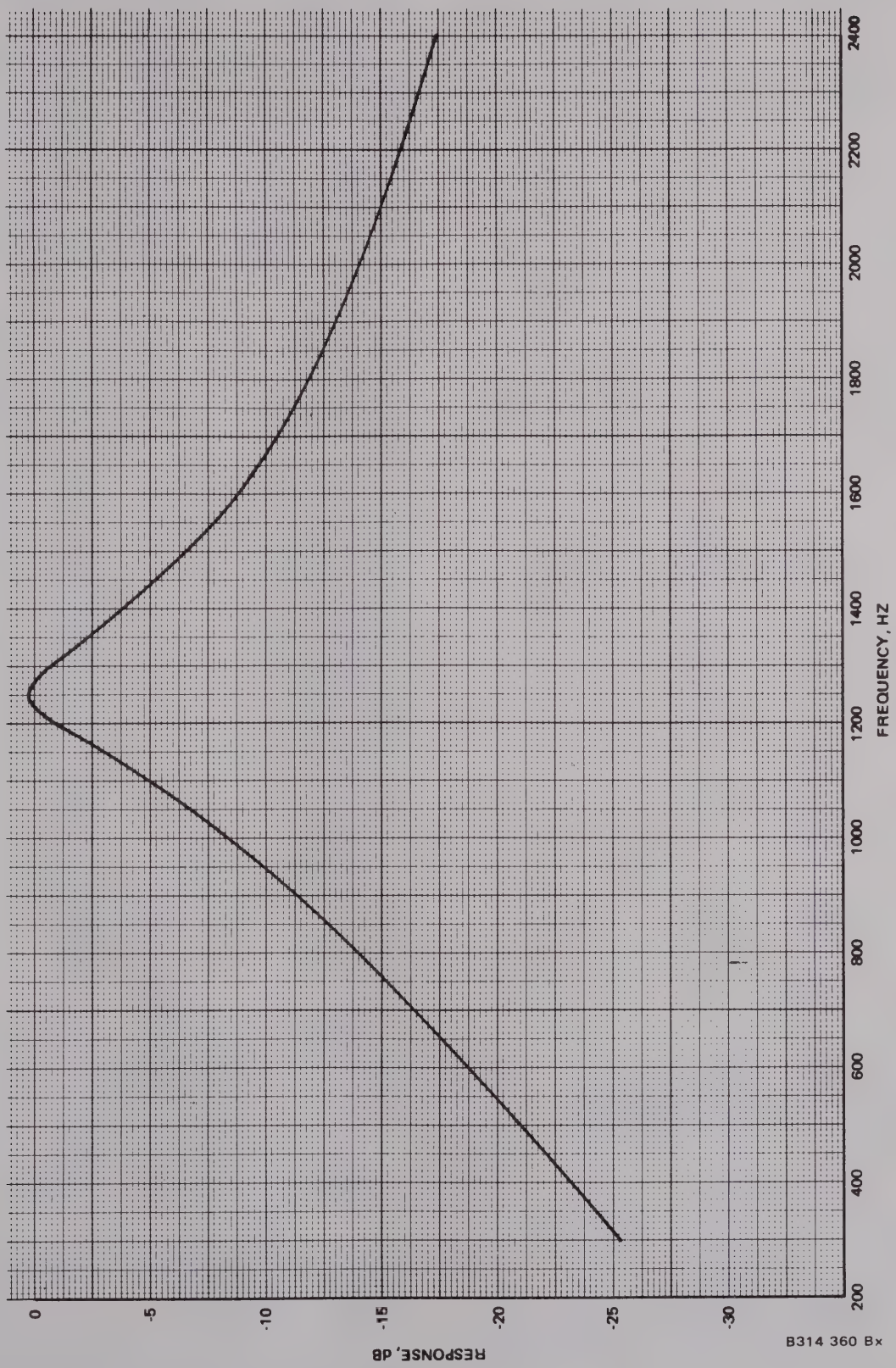


Figure 2-8. VFTG Receive Filter Bandpass Characteristics

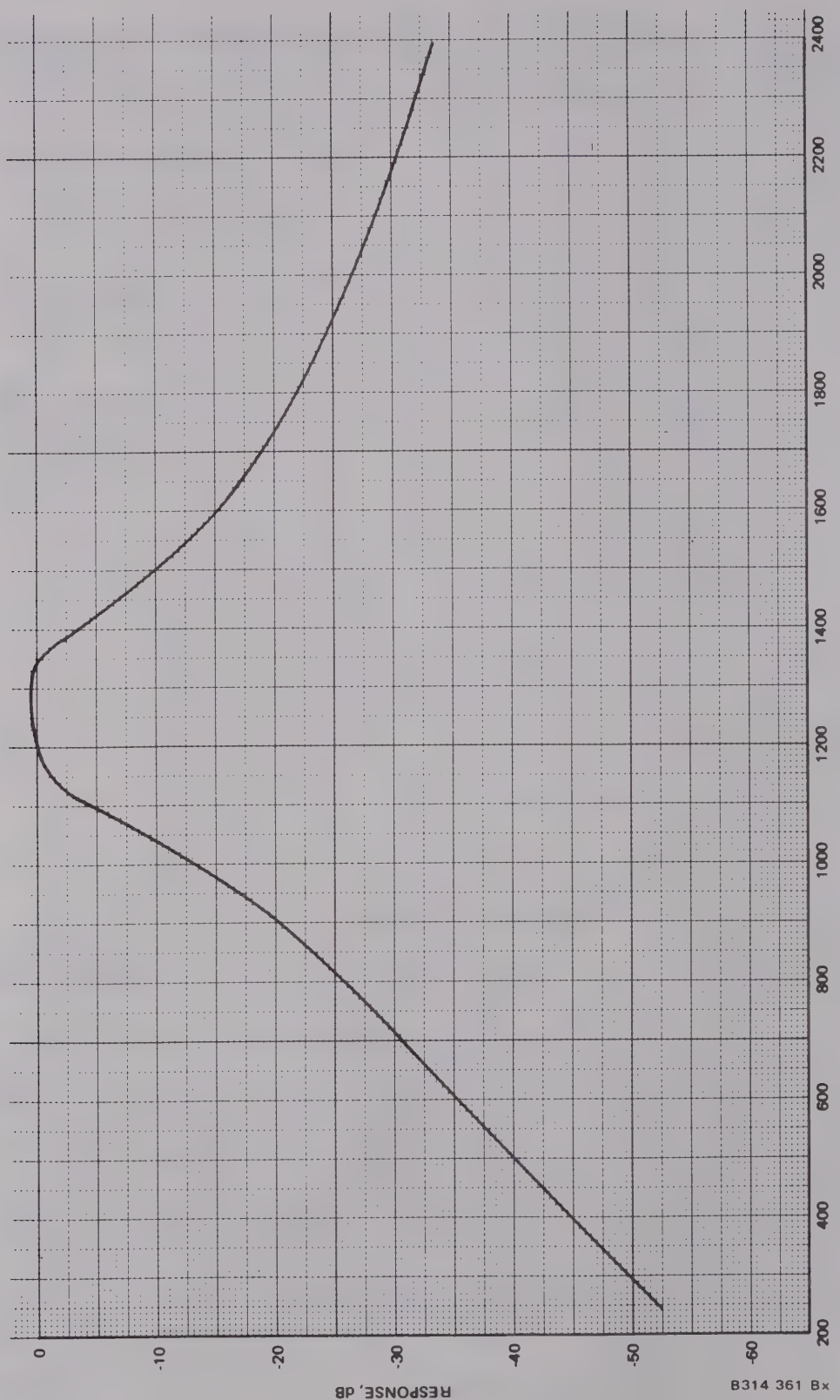


Figure 2-9. VFTG Transmit Filter Bandpass Characteristics

2-13. KEYER/CONVERTER CIRCUIT CARD PERFORMANCE TEST. Table 2-11 contains the procedures for performance testing the keyer/converter circuit card. Perform all steps in table 2-11 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the circuit card is considered to be operational. If the circuit card fails to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

2-14. KEYER/CONVERTER CIRCUIT CARD ADJUSTMENT PROCEDURES. The bias network in the converter circuits of the keyer/converter circuit card determines the amount of transmit loop current required to operate converter relay K2. The adjustment procedure consists of resistor trimming in each of the bias networks. The adjustment is normally required after replacement of converter relay K2 in order to match the characteristics of the new relay. The bias resistors (R6-R18) for the 60-milliampere neutral loop may be selected independently of the bias resistors for the other two loop options. The same is true for the 20-milliampere neutral loop option bias resistors (R7-R19). However, before selection of the bias resistors for the 20-milliampere polar loop option (R5-R11), the proper resistors must be selected and installed for both the 20- and 60-milliampere neutral loop option bias networks. These procedures require the removal and replacement of components on the circuit card. Therefore, it is recommended that the procedures in table 2-11 be performed first in order to determine the requirement for adjustment.

2-15. 30-mA Neutral Loop Option Adjustment.

a. Remove bias resistors R6 and R18 from the circuit card by clipping the leads as close as possible to the resistor body. (Refer to the illustrated parts breakdown of T.O. 31W2-4-196-2 for the location of the resistors on the circuit card.)

b. Set up the TS-3357/TSC-60(V) test set as follows:

1. Press the PWR indicator-switch to turn the test set power off.

2. Install the keyer/converter circuit card in the test connector. Secure the card to the guide posts with two 2-56 x 1/4 panhead screws.

3. Use the test leads supplied with the TS-3357/TSC-60(V) and substitute the RA potentiometer for resistor R6.

4. Use the test leads supplied with the TS-3357/TSC-60(V) and substitute the RB potentiometer for resistor R18.

5. Adjust the RA potentiometer for a dial indication of 1000.

6. Adjust the RB potentiometer for a dial indication of 1000.

7. Connect an 8300A digital voltmeter (set to the 10-volt range) to the KEYER/CONV CURRENT MONITOR test points (observe polarity: red=+, violet=-). Do not ground either 8300A input.

8. Set the KEYER/CONV loop option switch to 60N.

9. Set the OUTPUT DATA switch to CONV.

10. Connect a second 8300A to the OUTPUT DATA jack.

11. Press the PWR indicator-switch to turn the test set power on.

c. On the TS-3357/TSC-60(V), set the KEYER/CONV CUR ADJ control for an indication of +3.05 Vdc on the 8300A connected to CURRENT MONITOR test points.

d. Adjust the RB potentiometer (normally increase) just to the point where relay K2 energizes (8300A connected to OUTPUT DATA jack switches from 0 Vdc to +3.5 ±0.5 Vdc indication).

e. Record the dial setting of the RB potentiometer. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2 and select the resistor value closest to the RB potentiometer dial setting.

f. Set the RB potentiometer dial to the value selected in step e.

g. Set the KEYER/CONV CUR ADJ control for an indication of +2.95 Vdc on the 8300A connected to CURRENT MONITOR test points.

h. Adjust the RA potentiometer (decrease normally) just to the point where relay K2 deenergizes (8300A connected to OUTPUT DATA jack switches from +3.5 Vdc to 0 ±0.5 Vdc indication).

i. Record the dial setting for the RA potentiometer. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2 and select the resistor value closest to the RA potentiometer dial setting.

j. Set the RA potentiometer dial to the value selected in step i.

k. Set the KEYER/CONV CUR ADJ control for an indication of +3.10 Vdc on the 8300A connected to KEYER/CONV CURRENT MONITOR test points.

l. Verify that relay K2 is energized (8300A connected to CURRENT MONITOR test points indicates +3.5 ±0.5 Vdc). If relay K2 is not energized, refer to the resistor selection chart and select the next closest resistor value. Adjust the RB potentiometer to this value. The 8300A connected to OUTPUT DATA jack should now indicate that relay K2 is energized.

m. Set the KEYER/CONV CUR ADJ control for an indication of +2.90 Vdc on the 8300A connected to CURRENT MONITOR test points.

n. Verify that relay K2 is deenergized (8300A connected to OUTPUT DATA jack indicates 0 ±0.5 Vdc). If relay K2 is not deenergized, refer to the resistor selection chart and select the next closest resistor value. Adjust the RA potentiometer to this value. The 8300A connected to OUTPUT DATA jack should now indicate that relay K2 is deenergized.

o. Press the PWR indicator-switch on the TS-3357/TSC-60(V) to turn power off. Disconnect the test leads from the circuit card and remove the circuit card from the test connector.

p. Install the resistor from the selection chart in the R6 location whose value is indicated by the RA potentiometer dial.

q. Install the resistor from the selection chart in the R18 location whose value is indicated by the RB potentiometer dial.

2-16. 20-mA Neutral Loop Option Adjustment.

a. Remove bias resistors R7 and R19 from the circuit card by clipping the leads as close as possible to the resistor body. (Refer to the illustrated parts breakdown in T.O. 31W2-4-196-2.)

b. Set up the TS-3357/TSC-60(V) test set as follows:

1. Press the PWR indicator-switch to turn the test set power off.

2. Install the keyer/converter circuit card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws.

3. Use the test leads supplied with the test set and substitute the RA potentiometer for resistor R7.

4. Use the test leads supplied with the TS-3357/TSC-60(V) test set and substitute the RB potentiometer for resistor R19.

5. Adjust the RA potentiometer for a dial indication of 1000.

6. Adjust the RB potentiometer for a dial indication of 4800.

7. Connect a 8300A digital voltmeter to the KEYER/CONV CURRENT MONITOR test points. (Observe polarity as marked at the test points.)

8. Set the KEYER/CONV loop option switch to 20N.

9. Set the OUTPUT DATA switch to CONV.

10. Connect a second 8300A to the OUTPUT DATA jack.

11. Press the PWR indicator-switch to turn the test set power on.

c. On the TS-3357/TSC-60(V), set the KEYER/CONV CUR ADJ control for an indication of +2.0 Vdc on the 8300A connected to CURRENT MONITOR testpoints. Observe that relay K2 energizes (8300A connected to OUTPUT DATA jack indication switches from 0 Vdc to +3.5 ±0.5 Vdc).

d. Set the KEYR/CONV CUR ADJ control for an indication of +0.95 Vdc on the 8300A connected to CURRENT MONITOR test points.

e. Adjust the RB potentiometer (decrease normally) just to the point where relay K2 deenergizes

(8300A connected to OUTPUT DATA jack switches from +3.5 Vdc to 0 ±0.5 Vdc indication.)

f. Record the dial setting of the RB potentiometer. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2 and select the resistor value closest to the RB potentiometer dial setting.

g. Set the RB potentiometer dial to the value selected in step f.

h. Set the KEYER/CONV CUR ADJ control for an indication of +1.05 Vdc on the 8300A.

i. Adjust the RA potentiometer (decrease normally) just to the point where relay K2 energizes (8300A connected to OUTPUT DATA jack switches from 0 Vdc to +3.5 ±0.5 Vdc).

j. Record the dial setting of the RA potentiometer. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2 and select the resistor value closest to the RA potentiometer dial setting.

k. Set the RA potentiometer dial to the value selected in step j.

l. Set the KEYER/CONV CUR ADJ control for an indication of +0.90 Vdc on the 8300A connected to CURRENT MONITOR test points.

m. Verify that relay K2 is deenergized (8300A connected to OUTPUT DATA jack indicates 0 ±0.5 Vdc). If relay K2 is not deenergized, refer to the resistor selection chart and select the next closest value. Adjust the RB potentiometer to this value. The 8300A connected to OUTPUT DATA jack should now indicate that relay K2 is deenergized.

n. Set the KEYER/CONV CUR ADJ control for an indication of +1.10 Vdc on the 8300A connected to CURRENT MONITOR test points.

o. Verify that relay is energized (8300A connected to OUTPUT DATA jack indicates +3.5 ±0.5 Vdc). If relay K2 is not energized, refer to the resistor selection chart and select the next closest resistor value. The 8300A connected to OUTPUT DATA jack should now indicate that elay K2 is energized.

p. Press the PWR indicator-switch to turn the test set power off. Disconnect the test leads from the circuit card and remove the circuit card from the test connector.

q. Install the resistor from the selection chart in the R7 position whose value is indicated by the RA potentiommeter dial.

r. Install the resistor from the selection chart in the R19 location whose value is indicated by the RB potentiometer dial.

2-17. 20-mA Polar Loop Option Adjustment

a. Remove resistors R5 and R11 from the circuit card by clipping the leads as close as possible to the resistor body. (Refer to the illlustrated parts breakdown of T.O. 31W2-4-196-2.)

b. Set up the TS-3357/TSC-60(V) test set as follows:

1. Press the PWR indicator-switch to turn test set power off.

2. Install the keyer/converter circuit card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws.

3. Use the test leads supplied with the TS-3357/TSC-60(V) and substitute the RA potentiometer for resistor R5.

4. Use the test leads supplied with the TS-3357/TSC-60(V) and substitute the RB potentiometer for resistor R11.

5. Adjust the RA potentiometer for a dial indication of 1200.

6. Adjust the RB potentiometer for a dial indication of 2000.

7. Connect an 8300A digital voltmeter to the KEYER/CONV CURRENT MONITOR test points. (Observe polarity as marked at the test points.)

8. Set the KEYER/CONV loop option switch to 20P.

9. Set the OUTPUT DATA switch to CONV.

10. Connect a second 8300A to the OUTPUT DATA jack.

11. Press the PWR switch to turn test set power on.

c. Set the KEYER/CONV CUR ADJ control for an indication of +0.500 Vdc on the 8300A. Observe that relay K2 is energized (8300A connected to OUTPUT DATA jack indicates +3.5 ±0.5 Vdc).

d. On the TS-3357/TSC-60(V), set the KEYER/CONV CUR ADJ control for an indication of -0.050 Vdc on the 8300A connected to CURRENT MONITOR test points.

e. Adjust the RB potentiometer (increase normally) just to the point where relay K2 deenergizes (8300A connected to OUTPUT DATA jack switches from +3.5 Vdc to 0 ±0.5 Vdc).

f. Record the dial setting of the RB potentiometer. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2 and select the resistor value closest to the RB potentiometer dial setting.

g. Set the RB potentiometer to the value selected in step f.

h. Set the KEYER/CONV CUR ADJ control for an indication of +0.050 Vdc on the 8300A connected to CURRENT MONITOR TEST POINTS.

i. Adjust the RA potentiometer (decrease normally) just to the point where relay K2 energizes (8300A connected to OUTPUT DATA jack switches from 0 Vdc to +3.5 ±0.5 Vdc indication.)

j. Record the dial setting of the RA potentiometer. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-196-2 and select the resistor value closest to the RA potentiometer dial setting.

k. Set the RA potentiometer to the value selected in step j.

l. Set the KEYER/CONV CUR ADJ control for an indication of -0.100 Vdc on the 8300A connected to CURRENT MONITOR test points.

m. Verify that relay K2 is deenergized (8300A connected to OUTPUT DATA jack indicates 0 ±0.5 Vdc). If relay K2 is not deenergized, refer to the resistor selection chart and select the next closest value. Adjust the RB potentiometer to this value. The 8300A connected to OUTPUT DATA jack should now indicate that relay K2 is deenergized.

n. Set the KEYER/CONV CUR ADJ control for an indication of +0.100 Vdc on the 8300A connected to CURRENT MONITOR test points.

o. Verify that relay K2 is energized (8300A connected to OUTPUT DATA jack indicates +3.5 ±0.5 Vdc). If relay K2 is not energized, refer to the resistor selection chart and select the next closest value. Adjust the RA potentiometer to this value. The 8300A connected to OUTPUT DATA jack should now indicate that relay K2 is energized.

p. Press the PWR indicator-switch to turn the test set power off. Disconnect the test leads from the circuit card and remove the circuit card from the test connector.

q. Install the resistor from the selection chart in the R5 location whose value is indicated by the RA potentiometer dial setting.

r. Install the resistor from the selection chart in the R11 location whose value is indicated by the RB potentiometer dial setting.

Table 2-11. Keyer/Converter Circuit Card Performance Test

TEST EQUIPMENT REQUIRED:

Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V)
Digital Voltmeter, Fluke 8300A (2 required)

PRELIMINARY INSTRUCTIONS:

When the circuit card fails to meet any portion of the performance test, refer to T.O. 31W2-4-196-2 for the schematic diagram and the test point data contained thereon; then use standard trouble-shooting techniques to locate the faulty component.

Before probing any test points or before unsoldering or soldering any connections, the postcoating applied to the circuit card must be removed from the point where the work is to be performed.

Always check to be sure that power is turned off on the test set before installing or removing the circuit card.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	KEYER CIRCUIT PERFORMANCE TEST	Q1,K1		
1	Set up the TS-3357/TSC-60(V) test set as follows: Press PWR indicator-switch to turn power off. Set INPUT DATA switch to KEYER. Install keyer/converter card in test connector. Press PWR indicator-switch to turn power on.			
2	On the TS-3357/TSC-60(V), alternately set the DATA STATE switch to MARK and SPACE.			MARK and SPACE indicators on the TS-3357/TSC-60(V) alternately turn on and off.

Table 2-11. Keyer/Converter Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	CONVERTER CIRCUIT PERFORMANCE TEST			
	A. 60-mA Neutral Loop Test	K2, R6, R18		
3	Set up the TS-3357/ TSC-60(V) test set as follows: Set OUTPUT DATA switch to CONV. Connect an 8300A (set to the 10-volt range) to KEYER/CONV- CURRENT MONITOR test points. Observe indicated polarity (+ = red, - = violet). Verify that the 8300A inputs are not grounding either monitor test point. Connect a second 8300A to OUTPUT DATA jack. Set KEYER/CONV loop option switch to 60N.			
4	On the TS-3357/ TSC-60(V), adjust KEYER/ CONV CUR ADJ control to obtain an indication on the 8300A connected to CURRENT MONITOR test point of less than +2.0 Vdc.			The 8300A connected to OUTPUT DATA jack indicates converter relay K2 deenergized (-0.7 ±0.5 Vdc).
5	On the TS-3357/ TSC-60(V), adjust the KEYER/CONV CUR ADJ control to obtain an indication on the 8300A connected to CURRENT MONITOR test point of +3.4 Vdc.			The 8300A connected to OUTPUT DATA jack indicates relay K2 is energized (+3.5 ±1.0 Vdc).

Table 2-11. Keyer/Converter Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6	On the TS-3357/ TSC-60(V), adjust the KEYER/ CONV CUR ADJ control to obtain an indication on the 8300A of +2.6 Vdc.			The 8300A connected to OUTPUT DATA jack indicates that relay K2 is deenergized (-0.7 ± 0.5 Vdc).
	B. 20-mA Neutral Loop Test	K2, R19, R7		
7	Set up the TS-3357/ TSC-60(V) as described in step 3, except as follows: Set KEYER/CONV loop option switch to 20N.			
8	On the TS-3357/ TSC-60(V), adjust the KEYER/CONV CUR. ADJ control to obtain an indication on the 8300A connected to CURRENT MONITOR test points of less than +0.5 Vdc.			The 8300A connected to OUTPUT DATA jack indicates that relay K2 is deenergized (-0.7 ±0.5 Vdc).
9	On the TS-3357/ TSC-60(V), adjust the KEYER/CONV CUR ADJ control to obtain an indication on the 8300A connected to CURRENT MONITOR test points of +1.30 Vdc.			The 8300A connected to OUTPUT DATA jack indicates that relay K2 is energized (+3.5 ± 0.5 Vdc).
10	On the TS-3357/ TSC-60(V), adjust the KEYER/CONV CUR ADJ control to obtain an indication on the 8300A connected to CURRENT MONITOR test points of +0.7 Vdc.			The 8300A connected to OUTPUT DATA jack indicates that relay K2 is deenergized (-0.7 ±0.5 Vdc).
	20-mA Polar Loop Test.	K2, R5, R11		

Table 2-11. Keyer/Converter Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
11	Set up the TS-3357/ TSC-60(V) as described in step 3, except as follows: Set KEYER/CONV loop option switch to 20P.			
12	On the TS-3357/ TSC-60(V), adjust the KEYER/CONV CUR ADJ control to obtain an indication on the 8300A connected to CURRENT MONITOR test points of more than -0.5 Vdc.			The 8300A connected to OUTPUT DATA jack indicates that relay K2 is deenergized (-0.7 ±0.5 Vdc).
13	On the TS-3357/ TSC-60(V), adjust the KEYER/CONV CUR ADJ control to obtain an indication on the 8300A connected to CURRENT MONITOR test points of +0.3 Vdc.			The 8300A connected to OUTPUT DATA jack indicates that relay K2 is energized (+3.5 ±0.5 Vdc).
14	On the TS-3357/ TSC-60(V), adjust the KEYER/CONV CUR ADJ control to obtain an indication on the 8300A connected to CURRENT MONITOR test points of -0.3 Vdc.			The 8300A connected to OUTPUT DATA jack indicates that relay k2 is deenergized (-0.7 ±0.5 Vdc)

2-18. DELAY/DIVERSITY CIRCUIT CARD PERFORMANCE TEST. Table 2-12 contains the procedures for performance testing the delay/diversity circuit card. Perform all steps in table 2-12 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the circuit card is considered to be operational. If the circuit card fails to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

NOTE

The channel 15 fsk channel unit (part number 773-9895-115) is not equipped with the delay/diversity circuit card.

2-19. DELAY/DIVERSITY CIRCUIT CARD ADJUSTMENT PROCEDURE. The only adjustment required by the delay/diversity circuit card is filter delay potentiometer R18. This control is used to compensate for differential delay between the main and diversity channels. At the conclusion of the delay/diversity circuit card performance test, the control is left in the minimum delay (full cw) position. The adjustment of R18 is performed in the operating system and is described in T.O. 31S1-2TSC60-2 and in T.O.31S1-2TSC60-12.

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Table 2-12. Delay/Diversity Circuit Card Performance Test

TEST EQUIPMENT REQUIRED:

Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V)
Test Set TS-2915/UCC-3(V)
Audio Oscillator, HP-204C
Digital Voltmeter, Fluke 8300A
Oscilloscope, Tektronix 454
Electronic Frequency Counter, HP-5245L

PRELIMINARY INSTRUCTIONS:

Before attempting to probe any test points or before attempting to unsolder or solder any connections, the postcoating applied to the circuit card must be thoroughly removed from the solder pad where the work is to be performed.

If the circuit card fails to meet any portion of the performance test, refer to T.O. 31W2-4-196-2 for the schematic diagram and the test point data contained there; then use standard troubleshooting techniques to locate the faulty component.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	DATA DELAY TEST			
1	Set up the TS-3357/TSC-60(V) test set as follows: Press the PWR switch to turn power off. Install the delay/diversity card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws. Set the DATA STATE switch to DATA and the INPUT DATA switch to DELAY. Connect the DOT GEN output of the TS-2915/UCC-3(V) and the 454 channel A input to the INPUT DATA DIR jack, through the bunching jacks.			

Table 2-12. Delay/Diversity Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	Set the INHB switch to OFF. Set the OUTPUT DATA switch to DELAY DATA. Connect the 454 channel B input to OUTPUT DATA jack. Press the PWR indicator-switch to turn power on.			
2	Adjust the DATA DELAY control on the TS-3357/TSC-60(V) test set to the completely counterclockwise position (minimum delay).		Adjust potentiometer R18 on the circuit card for minimum delay (completely clockwise position).	The channel B waveform displayed by the 454 shall lag the channel A waveform by less than 15 microseconds. The channel B waveform shall be a square wave swinging from 0 ±0.5 Vdc to +2.5 ±0.5 Vdc.
3			Adjust potentiometer R18 on the circuit card for maximum delay (completely counterclockwise).	The channel B waveform displayed by the 454 shall lag the channel A waveform by more than 500 microseconds.
4	Adjust the DATA DELAY control on the TS-3357/TSC-60(V) test set to the maximum delay position (completely clockwise). Disconnect all patch cables from TS-3357/TSC-60(V) after completion of test.		Adjust potentiometer R18 on the circuit card to the minimum delay position.	The channel B waveform displayed by the 454 shall lag the channel A waveform by a minimum of 7 milliseconds.
	ENVELOPE DETECTOR TEST	U1		
5	Set up the TS-3357/TSC-60(V) test set as follows: Set the AUDIO NO 1 IN switch to DELAY.			

Table 2-12. Delay/Diversity Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	Connect the HP-204C, HP-5245L, and 454 to the AUDIO NO 1 IN jack through the bunching (BB) jacks. Connect the 8300A to the DELAY/DIV DC OUT and GND test points.			
6	Adjust the HP-204C output frequency to 1000 Hz with the amplitude set for 14.0-volt peak-to-peak indication on the 454 (4.95 volts rms).			The 8300A indicates +4.40 ±0.4 Vdc.
7	Reduce the output level from the HP-204C to produce an indication on the 454 of 2.0 volts peak-to-peak (0.7 volt rms).			The 8300A indicates +0.7 ±0.1 Vdc.
	VOLTAGE COMPARATOR AND SWITCHING TEST	U1, U2, U3		
8	Set up the TS-3357/TSC-60(V) test set as follows: Connect the DOT GEN output of the TS-2915/UCC-3(V) test set to the INPUT DATA DIV jack of the TS-3357/TSC-60(V). Set the INHIB switch to DIV. CONT. Set the INPUT DATA switch to DELAY.			

Table 2-12. Delay/Diversity Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
9	Adjust the HP-204C output frequency to 1000 Hz with the amplitude set for 14.0-volt peak-to-peak (4.95 volts rms) indication on the 454. Set the OUTPUT DATA switch to COMBINED DATA. Disconnect the 454 from the bunching (BB) jacks and connect to the OUTPUT DATA jack.			
10	Alternately set the DATA STATE switch to MARK and SPACE.			The 454 displays a dc level that switches as the DATA STATE switch is changed from the MARK to SPACE position.
11	Adjust the HP-204C output to 2.0 volts peak-to-peak (0.7 volt rms) at 1000 Hz.			The 454 displays a square-wave pattern at 37.5 Hz, indicating that the diversity data input has been selected for the data source.
12	Set the INHB switch to OFF and alternately set the DATA STATE switch to MARK and SPACE.			The 454 displays a dc level that switches each time that the DATA STATE switch is changed from MARK to SPACE.

2-20. AN/UCC-3(V) SPEECH-PLUS ASSEMBLY.

2-21. The following paragraphs provide procedures for performance testing and adjusting the speech-plus circuit cards contained on the speech-plus assembly.

2-22. SPEECH-PLUS CIRCUIT CARD PERFORMANCE TEST. Table 2-13 contains the procedures for performance testing the speech-plus circuit cards. Perform all steps in table 2-13 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the circuit card is considered to be operational. If the circuit card fails to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

2-23. SPEECH-PLUS CIRCUIT CARD ADJUSTMENT PROCEDURES. The speech-plus circuit card contains a transmit band-reject filter and a receive band-reject filter. The transmit filter consists of two cascade active filter stages while the receive filter consists of four cascade active filter stages. The adjustment consists of trimming the fixed resistor values in the feedback and null networks of each stage to produce the required frequency response and stage gain. The adjustment is normally required after replacement of the operational amplifier in the associated stage. Normally, only the stage containing the changed operational amplifier requires adjustment. These procedures require the removal and replacement of fixed resistors on the circuit card. Therefore, it is recommended that the procedures in table 2-13 be performed first in order to determine the requirement for adjustment. If the stage gain is low but the frequency response is within tolerance, only the feedback network of the affected stage needs to be adjusted. If the proper stage gain is obtained but the frequency response is out of tolerance, only the null network of the affected stage needs to be adjusted. The overall band-reject characteristics of the speech-plus transmit and receive circuits are shown in figures 2-10 and 2-11. A typical filter stage is shown in figure 2-12 . Since all transmit and receive filter stages are essentially of this same configuration, the adjustment procedures are provided for a typical stage and are applicable to both the transmit and receive filters. For convenience, separate procedures are provided for adjusting the feedback networks and the null networks.

2-24. Feedback Network Adjustment Procedures. Refer to table 2-14 to determine the reference designation for the feedback network tuning resistors (referred to throughout these procedures as resistors RA and RB) associated with the stage to be adjusted. Refer to figure 2-13 for the physical location of these resistors on the circuit card. Remove the resistors from the feedback network of the stage being adjusted by clipping the leads as close as possible to the body of the resistor. The leads that are left on the circuit card by clipping out these resistors shall be used to attach the RA and RB TUNING potentiometers of the TS-3357/TSC-60(V) test set during the tuning procedure. Remove the postcoating from these leads to ensure a proper electrical connection.

a. Connect the test equipment in the test setup shown in figure 2-4.

b. Press the PWR indicator-switch on the TS-3357/TSC-60(V) to turn power off.

c. Install the speech-plus circuit card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws.

d. Connect a set of test leads from jacks 1 and 2 of the RA TUNING potentiometer on the TS-3357/TSC-60(V) test set to the leads of the RA resistor removed from the circuit card. Set AUDIO NO. 1 OUT switch to SPEECH RX VOICE and install a 600-ohm dummy plug at AUDIO NO. 1 OUT jack. Also set AUDIO NO. 2 OUT switch to SPEECH TX COMP and install a 600-ohm dummy plug in the AUDIO NO. 2 OUT jack.

e. Connect a set of test leads from jacks 1 and 2 of the RA TUNING potentiometer on the TS-3357/TSC-60(V) test set to the leads of the RB resistor removed from the circuit card. Set both RA and RB potentiometers to 5000.

f. Connect a test lead from the TUNING INPUT NODE jack on the TS-3357/TSC-60(V) test set to the feedback network tuning input node (defined by the RC TUNING INPUT NODE JUNCTION column in table 2-14 and shown in figure 2-13).

g. Refer to the adjustment data for the associated stage number in table 2-15 , then adjust the TUNING INPUT potentiometer on the TS-3357/TSC-60(V) test set to the value specified by the R_{IN} column.

h. Set the TUNING capacitance selector switch on the TS-3357/TSC-60(V) test set to the value specified in table 2-15 by the C_{IN} column.

i. Press the PWR indicator-switch on the TS-3357/TSC-60(V) to turn power on.

j. Adjust the HP-204C audio oscillator to the stage frequency as specified by the RC INPUT F_O column in table 2-15.

k. Set the HP-204C output level for an indication of 0 dB on the HP-410C connected to the ATTENUATION INPUT jack of the TS-2919/UCC-3(V).

l. Set the ATTENUATION control of the TS-2915/UCC-3(V) to the value specified by the INPUT ATTENUATION column of table 2-15.

m. Set the 454 oscilloscope for horizontal input operation and adjust for six to eight divisions of horizontal deflection. Set the vertical attenuation of the 454 for 0.5-volt/cm sensitivity.

n. Observe the 454 trace, which should be a circular pattern.

o. Adjust the RB TUNING potentiometer on the TS-3357/TSC-60(V) to narrow the pattern to a single diagonal line.

p. On the HP-410C connected to the TUNING OUT jack of the TS-3357/TSC-60(V), set the range switch to 0 dB. Then adjust the RA TUNING potentiometer on the TS-3357/TSC-60(V) to obtain the indication on this HP-410C specified by the OUTPUT (dB) column of table 2-15.

q. The adjustments in steps o. and p. interact. Repeat steps o. and p. until the requirements of both steps are obtained simultaneously.

r. Record the values indicated by the dials of the RA and RB TUNING potentiometers.

s. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-194-2. From this chart, select the resistance value closest to the RA and RB TUNING potentiometer values recorded in step r.

t. Set the RA and RB TUNING potentiometers to the exact resistor values selected in step s.

u. Adjust the output frequency of the HP-204C as required to simultaneously obtain the single diagonal line on the 454 and the output level on the HP-410C (±0.5 dB) specified in step p. If the output frequency, as indicated by the HP-5245L, is within 3.0 Hz of the input frequency specified by step j., the stage feedback network is properly adjusted and the resistors selected in step s. are to be installed.

v. Perform the procedures described in table 2-13 after completing the adjustment.

2-25. Null Network Adjustment Procedures. Refer to table 2-14 to determine the reference designations for the null network tuning resistors (referred to throughout these procedures as resistors RC and RD) associated with the stage to be adjusted. Refer to figure 2-13 for the physical location of these resistors on the circuit card. Remove the resistors from the null network by clipping the leads as close as possible to the resistor body. The leads that are left on the circuit card by clipping out the resistors shall be used to attach the RA and RB TUNING potentiometers of the TS-3357/TSC-60(V) test set during the tuning procedures. Remove the postcoating from these leads to ensure a proper electrical connection.

a. Connect the test equipment in the test setup shown in figure 2-4 except that the 454 and TS-2915/UCC-3(V) are not required for this procedure.

b. Press the PWR indicator-switch on the TS-3357/TSC-60(V) to turn power off.

c. Install the speech-plus circuit card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws.

d. Connect a set of test leads from jacks 1 and 2 of the RA TUNING potentiometer on the test set to the leads of the RC resistor removed from the circuit card.

e. Connect a set of test leads from jacks 1 and 2 of the RB TUNING potentiometer on the test set to the leads of the RD resistor removed from the circuit card. Set both RA and RB potentiometers to 5000.

f. Connect the HP-204C to the null network tuning input node (defined by the NULL TUNING INPUT NODE JUNCTION column in table 5-100 and shown in figure 5-82). Set the AUDIO NO 1 OUT switch to SPEECH RX VOICE and the AUDIO NO 2 OUT switch to SPEECH TX COMP. Install 600-ohm dummy plugs in the AUDIO NO 1 and AUDIO NO 2 OUTPUT jacks.

g. Press the PWR indicator-switch on the TS-3357/TSC-60(V) to turn power on.

h. Adjust the HP-204C to the stage frequency as specified by the NULL INPUT F_O column in table 2-15.

i. Adjust the HP-204C output level for 0 dB at the null network tuning input node.

j. Adjust the RA and RB TUNING potentiometers on the TS-3357/TSC-60(V) for minimum indication on the HP-410C connected to the stage output test point as shown in figure 2-13 and specified in the stage output test point column of table 2-14.

k. The two adjustments of step j. interact and must be repeated to ensure that the absolute minimum indicatio is obtained.

l. Record the values indicated by the dials of the RA and RB TUNING potentiometers.

m. Refer to the resistor selection chart in the illustrated parts breakdown of T.O. 31W2-4-194-2. From this chart, select the resistance values closest to the RA and RB TUNING potentiometer values recorded in step l.

n. Set the RA and RB TUNING potentiometers to the exact resistor values selected in step m.

o. Adjust the output frequency of the HP-204C to obtain the minimum indication on the HP-410C. The HP-204C output frequency, as indicated by the HP-5245L, must be within ±3.0 Hz of the input frequency specified in step h.

p. Adjust the output frequency of the HP-204C to 1/10 of the input frequency specified in step h. The indication obtained on the HP-410C shall be up at least 40 dB (approximately 0-dB output) from the minimum indication obtained in step o.

q. If the requirements of steps o. and p. are obtained, the stage null network is properly adjusted and the resistors selected in step m. are to be installed.

r. Perform the procedures described in table 2-13 after completing the adjustment.

Table 2-13. Speech-Plus Circuit Card Performance Test

TEST EQUIPMENT REQUIRED:

Audio Oscillator, HP-209A
True RMS Voltmeter, HP-3400A
Electronic Frequency Counter, HP-5245L
Oscilloscope, Tektronix 454
Electronic Voltmeter, HP-410C
Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V)

PRELIMINARY INSTRUCTIONS:

Whenever the circuit card fails to meet any portion of the performance test, refer to T.O. 31W2-4-192-2 for the schematic diagram and the test point data contained there; then use standard trouble-shooting techniques to locate the faulty component.

Before probing any test point or before soldering or unsoldering any connections, the postcoating applied to the circuit card must be removed from the point where the work is to be performed.

Whenever an operational amplifier or any component in the band-reject filter networks that affects the band-reject filter tuning is replaced, the adjustment procedures for the circuit card are to be performed.

Always check to be sure that power is turned off on the TS-3357/TSC-60(V) test set before installing or removing the circuit card.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	TRANSMIT SECTION PERFORMANCE TEST			
	A. FSK Transmit Test	Combiner-Amplifier Stage		
1	Set up the TS-3357/TSC-60(V) test set as follows: Press PWR indicator switch to turn power off. Install speech-plus card in the test connector. Secure the card to the guide posts using two 2-56 x 1/4 panhead screws. Set AUDIO NO 2 IN switch to SPEECH FSK TX.			

Table 2-13. Speech-Plus Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	Connect the HP-5245L to monitor the output of the HP-209A. Connect the HP-209A to the AUDIO NO 2 IN jack. Adjust the HP-209A output to 2800 Hz. Temporarily connect the HP-3400A to the output of the HP-209A and set the output level to -11.0 dB. Set the AUDIO NO 2 OUT switch to SPEECH TX COMP. Connect the AUDIO NO 2 OUT jack to the bunching jacks. Install the 600-ohm dummy load in the bunching jacks.			
2	Connect the HP-3400A to the bunching jacks. Press PWR indicator-switch to turn power on.			The gain through the combiner-amplifier stage should provide an indication on the HP-3400A connected to the bunching jacks of 0 ±0.5 dB.
3	Use the 454 to check waveform at TP4 on the speech-plus circuit card.	TP4		Waveform displayed by the 454 is distortion free.
	B. Speech Transmit Test.	Transmit Band-Reject Filter		
4	Change the test setup described in step 1 as follows: Set the AUDIO NO 1 IN switch to SPEECH TX VOICE.			

Table 2-13. Speech-Plus Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	Connect the HP-209A to the AUDIO NO 1 IN jack. Monitor the HP-209A output with the HP-5245L.			
5	Temporarily connect the HP-3400A to the HP-209A and adjust the HP-209A output level to 0.0 dB (0.775 Vrms shall be 0-dB reference level) at 1000 Hz.			
6	After adjusting the HP-209A output level, connect the HP-3400A to the bunching jacks.			The gain through the transmit band-reject filter and the combiner amplifier should provide an indication on the HP-3400A connected to the bunching jacks of 0 ±1.0 dB.
7	Use the HP-3400A and check signal level at test points on speach-plus circuit card.	TP1, TP2, TP3, TP4		TP1 = -1.0 ±0.5 dB TP2 = -2.0 ±1.0 dB TP3 = -2.0 ±1.0 dB TP4 = +2.0 ±1.0 dB
8	Increase the HP-209A output level to obtain an indication of +16 dB on the HP-3400A connected to the bunching jacks.			
9	Use the 454 and check waveforms at test points on speech-plus circuit card.	TP1, TP2, TP3, TP4		Waveform displayed by the 454 at each test point is distortion free with no signs of clipping.
10	Adjust the HP-209A output to 0 dB.			

Table 2-13. Speech-Plus Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
11	Check the frequency response of the transmit band-reject filter by adjusting the HP-209A over the frequency range of 2755 Hz to 2855 Hz.			Output level, as indicated on the HP-3400A connected to the bunching jacks, down at least 20 dB over the frequency range 2755 Hz to 2855 Hz. (See figure 2-10 for band reject filter curve.)
	RECEIVE SECTION PERFORMANCE TEST			
	A. FSK Receive Test.	T3		
12	Change test setup described in step 1 as follows: Set AUDIO NO 2 IN switch to SPEECH RX COMP. Set AUDIO NO 2 OUT switch to RX FSK.			
13	Temporarily connect the HP-3400A to the HP-209A and adjust the HP-209A output to 0 dB at 2800Hz.			
14	After adjusting the HP-209A output level, connect the HP-3400A to the bunching jacks.			The insertion loss through transformer T3 should provide an indication of -14 ±1.0 dB on the HP-3400A connected to the bunching jacks.
	B. Speech Receive Test	RX Band-Reject Filter		
15	Change the test setup as follows: Set the AUDIO NO 1 OUT switch to SPEECH RX VOICE.			

Table 2-13. Speech-Plus Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
15 (Cont)	Temporarily connect the HP-3400A to the HP-209A and adjust the HP-209A output level to -2dB at 1000 Hz. Disconnect the lead from the AUDIO NO 2 OUT jack and connect it to the AUDIO NO 1 OUT jack. Install the 600-ohm dummy load in the bunching jacks.			
16	Connect the HP-3400A to the bunching jacks.			The gain of the receive band-reject filter should provide an indication of 0 dB ±2.0 dB on the HP-3400A connected to the bunching jacks.
17	Use the HP-3400A and check signal level at test points on the speech-plus circuit card.	TP5, TP6, TP7, TP8, TP9		TP5 = -2.5 ±1.0 dB TP6 = -1.0 ±2.0 dB TP7 = -2.5 ±2.0 dB TP8 = -2.0 ±2.0 dB TP9 = +2.5 ±2.0 dB
18	Increase the HP-209A output level to obtain an indication of +16 dB on the HP-3400A connected to the bunching jacks.			
19	Use the 454 and check waveforms at test points on speech-plus circuit card.	TP5, TP6, TP7, TP8, TP9		Waveform displayed by the 454 at each test point is distortion free with no signs of clipping.
20	Temporarily connect HP-3400A to the HP-209A output and adjust the HP-209A output level to -5 dB at 1000 Hz.			

Table 2-13. Speech-Plus Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
21	Connect the HP-3400A to the bunching jacks; then check the frequency response of the receive band reject filter by adjusting the HP-209A over the frequency range of 2730 Hz to 2880 Hz.			The HP-3400A, connected to the bunching jacks, indicates at follows: 2730 Hz: down at least 43 dB 2767 Hz: down at least 51 dB 2805 Hz: down at least 57 dB 2842 Hz: down at least 51 dB 2880 Hz: down at least 43 dB (See figure 2-11 for band-reject curve.)

Table 2-14. Speech-Plus Filter Test Nodes Reference Designators

FILTER STAGE	RC TUNING INPUT NODE JUNCTION	NULL TUNING INPUT NODE JUNCTION	RESISTOR RA REF DESIG	RESISTOR RB REF DESIG	RESISTOR RC REF DESIG	RESISTOR RD REF DESIG	STAGE OUTPUT TEST POINT
TRANSMIT FILTER							
U1	C3-R7	C1-R1	R9	R11	R3	R1	TP2
U2	C11-R18	C9-R13	R20	R22	R16	R13	TP3
RECEIVE FILTER							
U4	C22-R41	C20-R35	R45	R43	R37	R35	TP6
U5	C29-R56	C28-R48	R55	R58	R51	R48	TP7
U6	C37-R68	C36-R61	R67	R70	R65	R61	TP8
U7	C46-R78	C45-R73	R80	R82	R77	R73	TP9

Table 2-15. Speech-Plus Filter Adjustment Data

FILTER STAGE	R_{IN} (KILOHMS)	C_{IN} (pF)	RE INPUT F_O (Hz)	INPUT ATTENUATION	OUTPUT (dB)	NULL INPUT F_O (Hz)
TRANSMIT FILTER						
U1	90.9	600	2909.0	22 dB	0.0	2770.0
U2	97.6	600	2735.0	20 dB	-1.5	2840.0
RECEIVE FILTER						
U4	103.0	600	2568.0	14 dB	-1.2	2858.0
U5	86.6	600	3107.0	14 dB	-0.6	2746.0
U6	103.0	600	2544.0	28 dB	-0.7	2802.0
U7	165.0	310	3085.0	28 dB	-1.0	2802.0

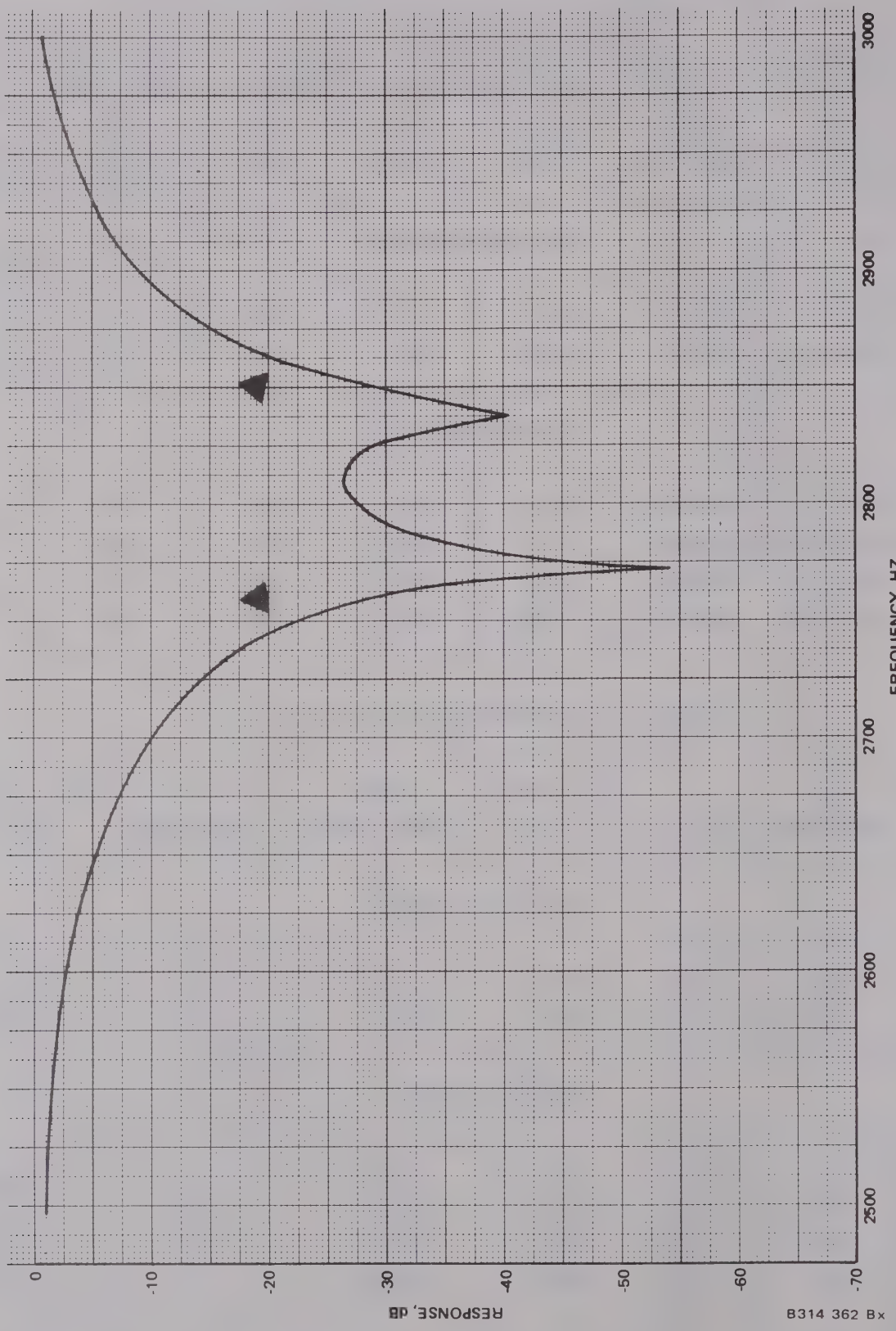


Figure 2-10. Speech-Plus Transmit Filter Band-Reject Characteristics

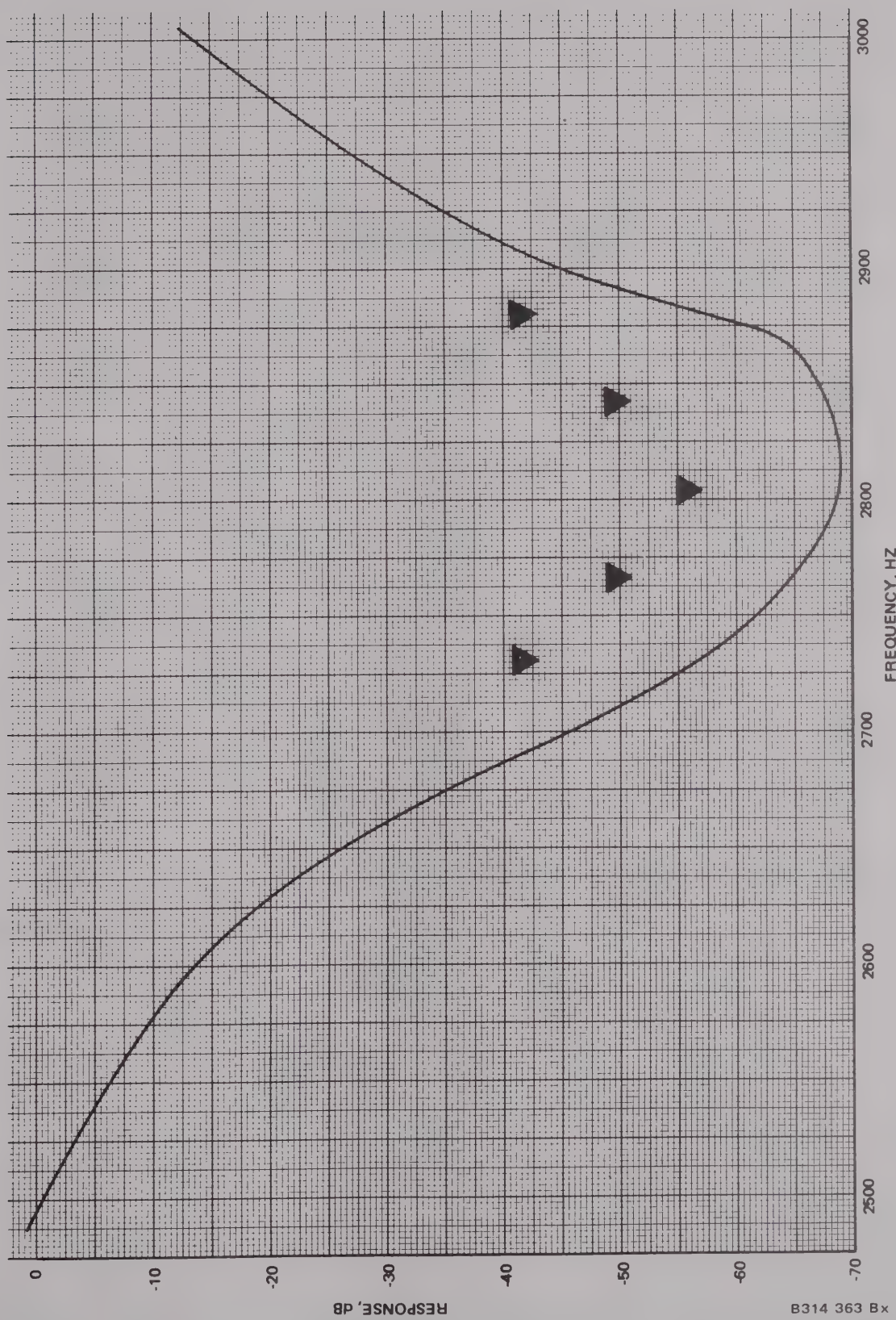


Figure 2-11. Speech-Plus Receive Filter Band-Reject Characteristics

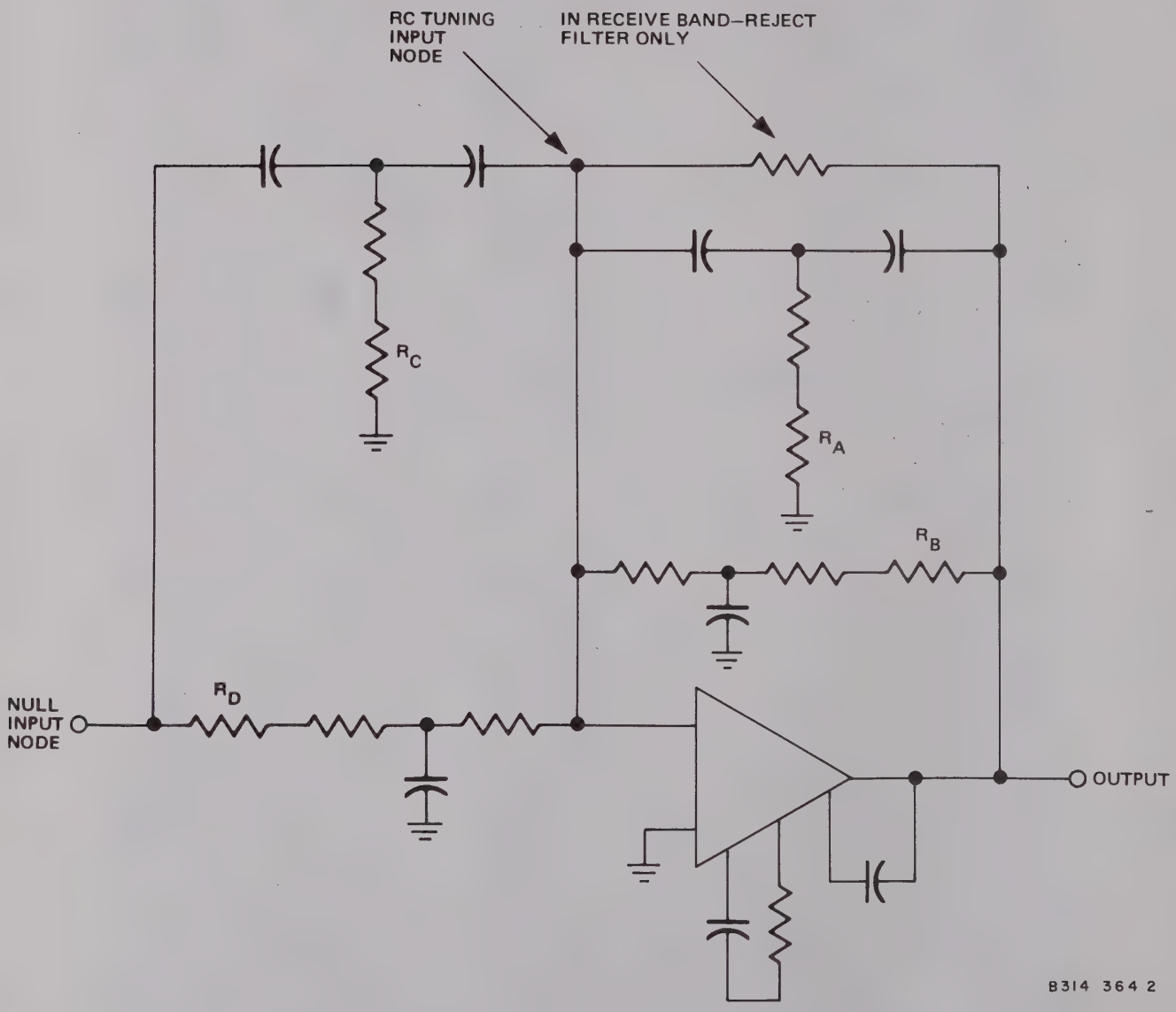


Figure 2-12. Typical Speech-Plus Filter Stage

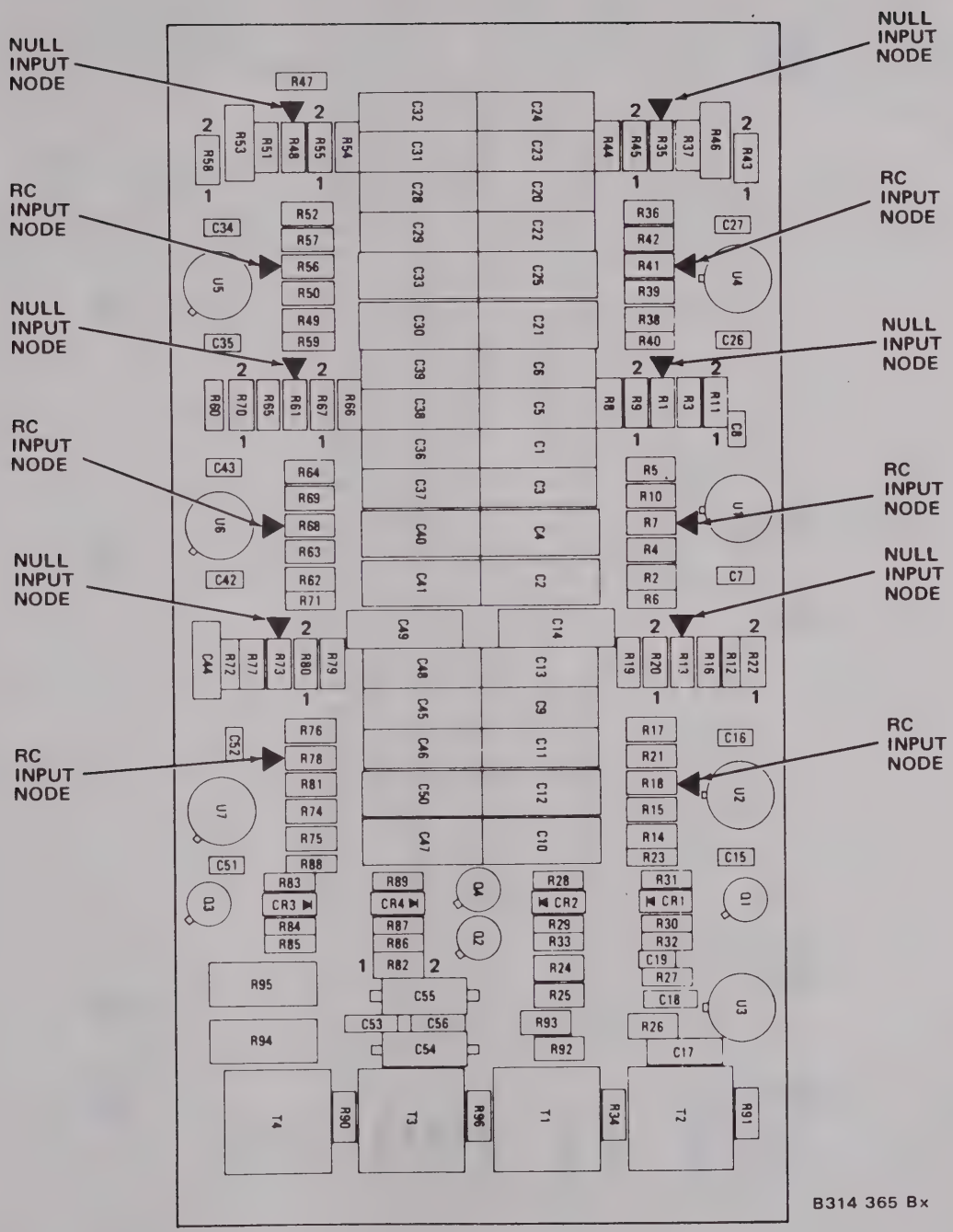


Figure 2-13. Speech-Plus Circuit Card Component and Test Point Locations (Sheet 1 of 2)

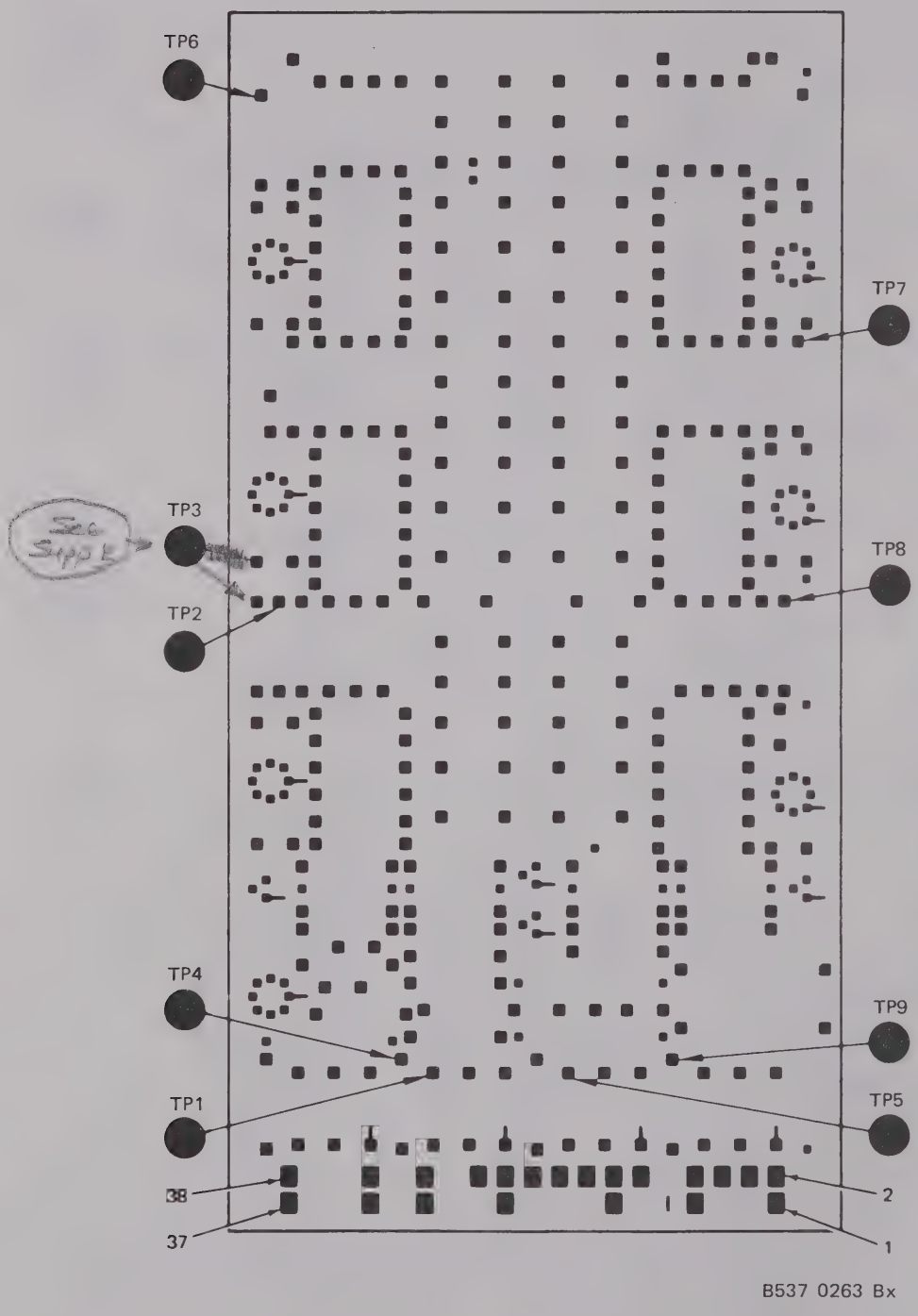


Figure 2-13. Speech-Plus Circuit Card Component and Test Point Locations (Sheet 2 of 2)

2-26. AN/UCC-3(V) VFTG OSCILLATOR MODULE.

2-27. The following paragraph provides the procedures for performance testing the circuits contained on the VFTG oscillator module. These procedures require the use of test equipment that is normally available only at depot level of maintenance.

2-28. VFTG OSCILLATOR MODULE PERFORMANCE TEST. Table 2-16 contains the procedures for performance testing the VFTG oscillator module. Perform all steps in table 2-16 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the test can be conducted with no malfunctions, the VFTG oscillator module is considered to be operational. If the VFTG oscillator module fails to meet a performance test standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

2-29. VFTG OSCILLATOR MODULE ADJUSTMENT PROCEDURE. There are no adjustments required for the VFTG oscillator module.

Table 2-16. VFTG Oscillator Module Performance Test

TEST EQUIPMENT REQUIRED:

Oscilloscope, Tektronix 454
Electronic Frequency Counter, HP-5245L
Electronic Test Extender Card MX-9019/TSC-60(V)
Communication Central Training Set AN/TSC-60(V)1-T2

PRELIMINARY INSTRUCTIONS:

Before attempting to probe any test points or before attempting to solder or unsolder any connections, the postcoating applied to the circuit card must be thoroughly removed from the solder pad where the work is to be performed.

If the circuit card fails to meet any portion of the performance test, refer to T.O. 31W2-4-195-2 for the schematic diagram and the test point data contained there; then use standard troubleshooting techniques to locate the faulty component.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Use the MX-9019/TSC-60(V) to extend the VFTG oscillator from the hot mockup.			
2	Turn on the low-voltage power supply for the hot mockup.			
	NOTE In the following tests ground all test equipment to P1-43.			
3	Connect the 454 to pin 30 of thin-film oscillator U1.	U1-30		The 454 display is a sine wave with an amplitude of 1.5 to 2.5 volts peak-to-peak.
4	Disconnect the 454 and connect the HP-5245L to pin 30 of thin-film oscillator U1.			The HP-5245L indicates 315,520, kHz ±125 Hz.
5	Connect the 454 to pin 16 of thin-film oscillator U1.			The 454 display is a sine wave with an amplitude of 1.5 to 2.5 volts peak-to-peak.
6	Disconnect the 454 and connect the HP-5245L to pin 16 of thin-film assembly U1.			The HP-5245L indicates 337,280 kHz ±125 Hz.

Table 2-16. VFTG Oscillator Module Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
7	Connect the 454 to TP1 on the circuit card.	TP1		The 454 displays a square-wave pattern with levels between 0 and +1.5 Vdc.
8	Connect the 454 to TP2 on the circuit card.	TP2		Same as step 7.
9	Connect the 454 to TP3 on the circuit card.	TP3		The 454 displays a square-wave pattern at the Y1 crystal frequency with levels between 0 and +3.5 Vdc.
10	Connect the 454 to TP4 on the circuit card.	TP4		Same as step 9, except at the Y2 crystal frequency.
11	Connect the 454 to TP5 on the circuit card.	TP5		The 454 displays a level of approximately +0.8 Vdc.
12	Connect the 454 to TP6 on the circuit card.	TP6		Same as step 11.
13	Connect the 454 to TP7 on the circuit card.	TP7		The 454 displays a level of approximately +0.05 Vdc.
14	Connect the 454 to TP8 on the circuit card.	TP8		Same as step 13.
15	Connect the 454 to TP9 on the circuit card.	TP9		The 454 displays a level of 0 Vdc.
16	Connect the 454 to TP10 on the circuit card.	TP10		Same as step 15.
17	Connect the 454 to TP11 on the circuit card.	TP11		The 454 displays a square-wave pattern with levels of 0 and +2.5 Vdc at the Y1 crystal frequency.
18	Connect the 454 to TP12 on the circuit card.	TP12		Same as step 17, except the square wave is at the Y2 crystal frequency.

Table 2-16. VFTG Oscillator Module Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
19	Connect a jumper lead from P1-30 to P1-32 on the circuit card and repeat steps 17 and 18. Remove jumper lead at end of step.	TP11		The square-wave pattern displayed in steps 17 and 18 changes to a level of approximately +0.05 Vdc.
20	Connect the 454 to TP13 on the circuit card.	TP13		The 454 indicates a level of approximately +12 Vdc.
21	Momentarily remove crystal Y1 from the socket.			Failure indicator DS1 turns on to indicate a failure.
22	Momentarily remove crystal Y2 from the socket.			Failure indicator DS1 turns on to indicate a failure.

2-30. POWER SUPPLY PP-6341/UCC-3(V).

2-31. The following paragraphs provide procedures for performance testing and adjusting the PP-6341/UCC-3(V) power supply. These procedures require the use of special test equipment that is normally available only at depot level of maintenance.

2-32. POWER SUPPLY PP-6341/UCC-3(V) PERFORMANCE TEST. Table 2-17 contains the procedures for performance testing the PP-6341/UCC-3(V) power supply. The test setup is shown in figure 2-14. Perform all steps in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the power supply is considered to be operational. If the power supply fials to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

2-33. POWER SUPPLY PP-6341/UCC-3(V) ADJUSTMENT PROCEDURES. Perform the following procedural steps to adjust the power supply.

a. Perform the preliminary instructions described in table 2-17.

b. Connect the test setup as shown in figure 2-14 for the +62.5-Vdc output.

c. Set the power switch to ON.

d. Adjust the variable load for an indication of 1.0 ampere on the AN/PSM-6.

e. Connect the 8300A digital voltmeter between TP1 and TP3.

f. Adjust potentiometer R18 on the power supply regulator circuit card for an indication of +62.5 ±2.0 Vdc on the 8300A.

g. Connect the test setup as shown in figure 2-14 for the -62.5-Vdc output.

h. Adjust the variable load for an indication of 1.0 ampere on the AN/PSM-6.

i. Connect the 8300A between TP2 and TP3.

j. Adjust potentiometer R36 on the power supply regulator circuit card for an indication of -62.5 ±2.0 Vdc on the 8300A.

Table 2-17. Power Supply PP-6341/UCC-3(V) Performance Test

TEST EQUIPMENT REQUIRED:

Multimeter AN/PSM-6
Digital Voltmeter, Fluke 8300A
Blower, Master Appliance Corp. Model HG-301J (or equivalent)
Variable Load, 0 to 100 ohms, 200 watts
Power Cable, Locally fabricated (See preliminary instructions.)

PRELIMINARY INSTRUCTIONS:

1. To fabricate the power cable for maintenance, use connector type MS3102R14S-7S (or equivalent), a 3-conductor, 18-gauge cable, and a 3-prong plug for mating with the local power receptacles. Connect the cable to the connector for 120 Vac on pin A, 120 Vac return on pin B, and ground on pin C. Observe the same polarity when connecting the cable to the 3-prong plug.

2. Strap the power supply for primary power input requirements as described in chapter 2 of T.O. 31W1-2UCC3-12.

3. Strap the power supply for polar loop operating mode as described in chapter 2 of T.O. 31W1-2UCC3-12.

4. In the performance of these procedures, the cover is removed from the power supply. This interrupts the flow of cooling air, which is normally drawn in through the air filter on the front and exhausted out the rear by the fan. To compensate for the loss of cooling air, supplemental air must be directed onto the heat sinks of the series regulator transistors to prevent damage from the heat. Place the blower so that the cooling air is directed onto the transistors. The heat sink plate must be displaced to gain access to the circuit card.

CAUTION

Do not maintain load conditions in excess of 3 amperes longer than 30 seconds.

5. Refer to the power supply schematic diagram in T.O. 31W1-2UCC3-12 for the location of the test points.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Adjust the variable resistor for maximum resistance. Connect the test setup as shown in figure 2-14 for +62.5-Vdc output.	TP1 TP3	Set power switch to ON.	The +60-Vdc and -60-Vdc indicators on the front panel of the power supply turn on.

Table 2-17. Power Supply PP-6341/UCC-3(V) Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2	Adjust the load resistor for an indication of 1.0 ampere on the AN/PSM-6. Connect the 8300A between TP4 and common (TP3).	TP4		The 8300A indicates +80 ±5.0 Vdc.
3	Connect the 8300A between TP5 and TP3 (common).	TP5		The 8300A indicates +77 ±5.0 Vdc.
4	Connect the 8300A between TP6 and TP3.	TP6		The 8300A indicates 0 to +1.5 Vdc.
5	Connect the 8300A between TP7 and TP3.	TP7		The 8300A indicates +66 ±3.0 Vdc.
6	Connect the 8300A between TP8 and TP3.	TP8		The 8300A indicates 0 to +1.5 Vdc.
7	Connect the 8300A between TP9 and TP3.	TP9		The 8300A indicates +6 ±1.0 Vdc.
8	Connect the 8300A between TP9 and TP10.	TP9, TP10		The 8300A indicates 0 ±0.5 Vdc.
9	Connect the 8300A between TP11 and TP3.	TP11		The 8300A indicates +64.5 ±3.5 Vdc.
10	Connect the 8300A between TP12 and TP3.	TP12		The 8300A indicates +63.5 ±3.5 Vdc.
11	Connect the 8300A between TP1 and TP3.	TP1	Adjust potentiometer R18 on the regulator card if required.	The 8300A indicates +62.5 ±2.0 Vdc.
12	Adjust the load resistance for an indication of 3.0 amperes on the AN/PSM-6.	TP1		The 8300A indicates +62.5 ±2.0 Vdc.
13	Adjust the variable load for maximum resistance and then connect the test setup shown in figure 2-14 for -62.5-Vdc output. Adjust the	TP2 TP3		

Table 2-17. Power Supply PP-6341/UCC-3(V) Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
13 (Cont)	the variable load for an indication of 1.0 ampere on the AN/PSM-6.			
14	Connect the 8300A between TP13 and TP3.	TP13		The 8300A indicates +17 ±5.0 Vdc.
15	Connect the 8300A between TP14 and TP3.	TP14		The 8300A indicates +14 ±5 Vdc.
16	Connect the 8300A between TP15 and TP3.	TP15		The 8300A indicates -62.5 ±5.0 Vdc.
17	Connect the 8300A between TP16 and TP3.	TP16		The 8300A indicates +3.5 ±3.0 Vdc.
18	Connect the 8300A between TP17 and TP3.	TP17		The 8300A indicates -61 ±3.0 Vdc.
19	Connect the 8300A between TP18 and TP3.	TP18		The 8300A indicates -56.5 ±5.0 Vdc.
20	Connect the 8300A between TP18 and TP19.	TP18, TP19		The 8300A indicates 0 ±0.5 Vdc.
21	Connect the 8300A between TP20 and TP3.	TP20		The 8300A indicates +2 ±1.0 Vdc.
22	Connect the 8300A between TP21 and TP3.	TP21		The 8300A indicates 0 to +2.0 Vdc.
23	Connect the 8300A between TP2 and TP3.	TP2	Adjust potentiometer R36 on the regulator card if required.	The 8300A indicates -62.5 ±2.0 Vdc.
24	Adjust the load resistance for an indication of 3.0 amperes on the AN/PSM-6.	TP2		The 8300A indicates -62.5 ±2.0 Vdc.

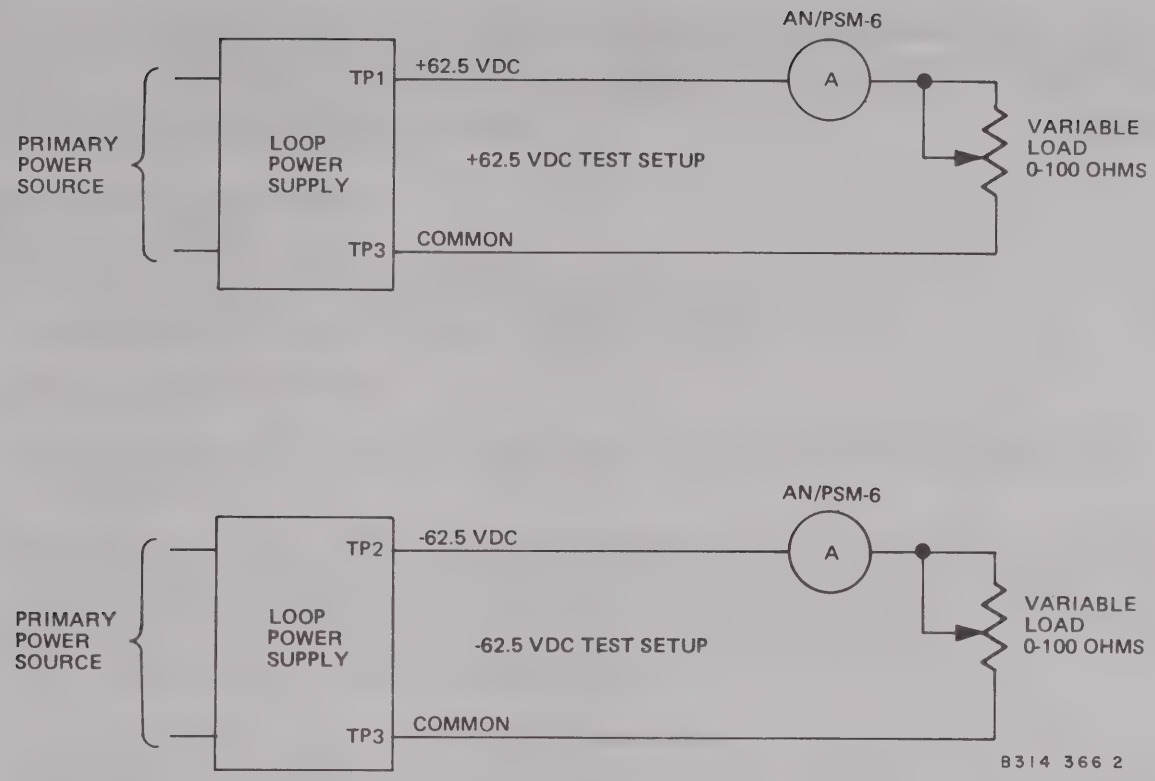


Figure 2-14. Power Supply PP-6341/UCC-3(V) Test Setup

2-34. AN/UCC-3(V) LOW-VOLTAGE POWER SUPPLY.

2-35. The low-voltage power supply is part of Electrical Equipment Chassis CH-642/UCC-3(V)1 and Combiner-Power Supply CU-1895/UCC-3(V). The following paragraphs provide procedures for performance testing and adjusting the low-voltage power supply. These procedures require the use of special test equipment that is normally available only at the depot level of maintenance.

2-36. AN/UCC-3(V) LOW-VOLTAGE POWER SUPPLY PERFORMANCE TEST. Table 2-18 contains the procedures for performance testing the low voltage power supply. The test setup is shown in figure 2-15 . Perform all steps in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the power supply is considered to be operational. If the power supply fails to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test. In addition to this performance test, a separate performance test for the +3.6-Vdc regulator circuit card contained in the power supply is provided by table 2-19.

2-37. AN/UCC-3(V) LOW-VOLTAGE POWER SUPPLY ADJUSTMENT PROCEDURE. The adjustments required for the low-voltage power supply are potentiometers R24 and R27 on the +3.6-Vdc regulator circuit card. Potentiometer R24 is used to adjust for the proper output voltage, and R27 is used to adjust the point at which any increase in load current from the +3.6-Vdc regulator circuit card causes a decrease in output voltage and current. To adjust the low-voltage power supply, perform steps 29 through 33 in table 2-18.

2-38. +3.6-VDC REGULATOR CIRCUIT CARD PERFORMANCE TEST. Table 2-19 contains the procedures for performance testing the +3.6-Vdc regulator card. Perform all steps in table 2-19 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the test can be completed with no malfunctions, the circuit card is considered to be operational. If the circuit card

fails to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

2-39. +3.6-VDC REGULATOR CIRCUIT CARD ADJUSTMENT PROCEDURES. Adjustment of the +3.6-Vdc regulator circuit card is performed during the performance testing (table 2-19).

This space is left blank intentionally.

Table 2-18. AN/UCC-3(V) Low-Voltage Power Supply Performance Test

TEST EQUIPMENT REQUIRED:

Digital Voltmeter, Fluke 8300A
Multimeter AN/PSM-6
Variable Load, 0 to 100 ohms (200 watts)
Power Control Cable, to be locally fabricated (See preliminary instructions.)
Power Input Cable, to be locally fabricated (See preliminary instructions.)

PRELIMINARY INSTRUCTIONS:

1. Strap the power supply for primary power input requirements as described in chapter 2 of T.O. 31W2-4-197-2.

2. Fabricate a power control cable using an MS3106R-16S-1P type connector (or equivalent) and an MS35058-22 (or equivalent) ac power switch. Use AWG-18 size wires for the cable. Connect a wire from pin C of the connector to the common terminal of the switch. Connect a wire from pin E of the connector to the normally open (power-on position) terminal of the switch. This cable is used to control the power to the power supply.

3. Fabricate an ac power input cable using a DPXA-13-33S type connector (or equivalent), a 3-conductor 18-gauge cable, and a 3-prong plug. Connect the ac hot wire to pin 1 of the connector. Connect the ac return wire to pin 2 of the connector. Connect the ac ground wire to pin 3 of the connector. Connect a 3-prong ac connector suitable for mating with the local ac source to the other end of the cable.

4. Refer to the schematic diagram in T.O. 31W2-4-197-2 for the location of test points.

5. Set the power switch on the power control cable to off; then connect the cable to J1 on the power supply.

6. Connect the ac power input cable to P1 on the power supply; then connect the cable to the ac power source.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Connect the 8300A between TP1 and TP4.	TP1	Set power switch on the power control cable to turn power on.	The 8300A indicates +3.6 ±0.18 Vdc. The +3-Vdc indicator is on.
2	Connect the 8300A between TP2 and TP4.	TP2		The 8300A indicates +12 ±0.6 Vdc. The +12-Vdc indicator is on.
3	Connect the 8300A between TP3 and TP4.	TP3		The 8300A indicates -12 ±0.6 Vdc. The -12-Vdc indicator is on.

Table 2-18. AN/UCC-3(V) Low-Voltage Power Supply Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4	Connect the 8300A between TP5 and TP4.	TP5		The 8300A indicates +20.6 ±2.6 Vdc.
5	Connect the 8300A between TP6 and TP4.	TP6		The 8300A indicates +12.7 ±1.0 Vdc.
6	Connect the 8300A between TP7 and TP4.	TP7		The 8300A indicates 0 to +1.5 Vdc.
7	Connect the 8300A between TP8 and TP4.	TP8		The 8300A indicates 0 to +1.5 Vdc.
8	Connect the 8300A between TP9 and TP4.	TP9		The 8300A indicates +12 ±0.8 Vdc.
9	Connect the 8300A between TP10 and TP4.	TP10		The 8300A indicates +7.7 ±2.0 Vdc.
10	Connect the 8300A between TP11 and TP4.	TP11		The 8300A indicates 0 to +1.5 Vdc.
11	Connect the 8300A between TP12 and TP4.	TP12		The 8300A indicates -11.3 ±1.0 Vdc.
12	Connect the 8300A between TP13 and TP4.	TP13		The 8300A indicates -11.4 ±1.0 Vdc.
13	Connect the 8300A between TP14 and TP4.	TP14		The 8300A indicates 0 to 1.0 Vdc.
14	Connect the 8300A between TP15 and TP4.	TP15		The 8300A indicates +3.6 ±0.2 Vdc.
15	Connect the 8300A between TP16 and TP4.	TP16		The 8300A indicates +3.8 ±0.2 Vdc.
16	Connect the 8300A between TP18 and TP4.	TP18		The 8300A indicates 0 to +1.5 Vdc.
17	Connect the 8300A between TP19 and TP4.	TP19		The 8300A indicates +5.3 ±1.0 Vdc.
18	Connect the 8300A between TP20 and TP4.	TP20		The 8300A indicates +4.6 ±1.0 Vdc.
19	Connect the 8300A between TP22 and TP4.	TP22		The 8300A indicates +6.0 to +12.0 Vdc.

Table 2-18. AN/UCC-3(V) Low-Voltage Power Supply Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
20	Connect the 8300A between TP23 and TP4.	TP23		The 8300A indicates +4.3 ±1.0 Vdc.
21	Adjust the variable load for maximum resistance, then connect the test setup for the +12-Vdc test as shown in figure 2-15.			
22	Adjust the variable load for an indication of 1.0 ampere on the AN/PSM-6.			
23	Connect the 8300A between TP2 and TP4.	TP2		The 8300A indicates +12 ±0.6 Vdc.
24	Slowly adjust the variable load for an indication of 3.0 amperes on the AN/PSM-6.	TP2		The 8300A indicates +12 ±0.6 Vdc.
25	Adjust the variable load for maximum resistance; then connect the test setup for the -12-Vdc test as shown in figure 2-15.			
26	Adjust the variable load for an indication of 1.0 ampere on the AN/PSM-6.			
27	Connect the 8300A between TP3 and TP4.	TP3		The 8300A indicates -12 ±0.6 Vdc.
28	Slowly adjust the variable load for an indication of 3.0 amperes on the AN/PSM-6.			The 8300A indicates -12 ±0.6 Vdc.

Table 2-18. AN/UCC-3(V) Low-Voltage Power Supply Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
29	Adjust the variable load for maximum resistance, then connect the test setup for the +3.6-Vdc test as shown in figure 2-15.			
30	Adjust the variable load for an indication of 1.0 ampere on the AN/PSM-6.			
31	Connect the 8300A between TP1 and TP4.	TP1	Adjust potentiometer R24 as required to obtain the proper output voltage.	The 8300A indicates +3.6 ±0.18 Vdc.
32	Adjust the variable load for an indication of 5.0 amperes on the AN/PSM-6.	TP1		The 8300A indicates +3.6 ±0.18 Vdc.
33	Slowly adjust the variable load for an indication of 6.0 amperes on the AN/PSM-6.	TP1	Adjust potentiometer R27 as required so that any further decrease in load resistance also causes the output voltage and current to decrease.	

Table 2-19. +3.6-VDC Regulator Circuit Card Performance Test

TEST EQUIPMENT REQUIRED:

Power Supply HP-6104A or equivalent
Digital Voltmeter, Fluke 8300A
Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V)
Test Set TS-2915/UCC-3(V)
Multimeter AN/PSM-6

PRELIMINARY INSTRUCTIONS:

Remove all the postcoating from the terminals on the circuit card that mate with the pins of the test connector to ensure electrical connection.

NOTE

It is physically and electrically feasible to test the +3.6-Vdc regulator card on the TS-3357/TSC-60(V) without disconnecting all the leads from the power supply. However, when tested in this manner, current-limiting resistor R21 must be removed from the circuit by unsoldering the leads from terminals 17 and 18 on the circuit card. Refer to the schematic diagram in T.O. 31W2-4-197-2 for the physical location of the solder terminals.

Adjust potentiometer R24 on the circuit card counterclockwise to the end of the range.

Adjust R27 clockwise to the end of the range.

Adjust the HP-6104A power supply output for 0 Vdc.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Set up the TS-3357/TSC-60(V) test set as follows: Connect the outputs of the HP-6104A to the LV PWR SPLY 0 to 5 VDC jacks. Connect a patch cord to the LV PWR SPLY CUR OUT jack. (Leave the other end unterminated so that the LOAD ADJ control is disconnected.) Set the LOAD ADJ control to the maximum counterclockwise position.			

Table 2-19. +3.6-VDC Regulator Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	Press the PWR indicator-switch to turn test set power off. Install the low-voltage regulator circuit card in the test connector. (Refer to T.O. 3307-76-33-2 for instructions to mount the regulator card on the test set.) Connect the 8300A to the LV PWR SPLY DC OUT and GND test points.			
2	Press the PWR indicator-switch to turn test set power on.	+3.6 VDC output		The 8300A indicates approximately +3.0 Vdc.
3	Slowly adjust the HP-6104A output from 0 Vdc to +3.6 Vdc and then to +5.0 Vdc.			The 8300A indicates approximately +3.0 Vdc.
4	Set the FUNCTION switch on the TS-2915/UCC-3(V) to 25 MA. Connect the patch cord from the LV PWR SPLY CUR OUT jack on the TS-3357/TSC-60(V) to the DC LOOP jack on the TS-2915/UCC-3(V) test set.			
5	Ensure that the LOAD ADJ control on the TS-3357/TSC-60(V) is set to the maximum counterclockwise position.			The meter on the TS-2915/UCC-3(V) indicates less than 20-mA load current.
6			Adjust potentiometer R24 on the circuit card clockwise for an indication on the 8300A of +3.6 ±0.01 Vdc.	

Table 2-19. +3.6- VDC Regulator Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
7	On the TS-2915/UCC-3(V), set the FUNCTION switch to 75 MA. Set LOAD ADJ control on the TS-3357/TSC-60(V) clockwise for an indication of 50 mA on the meter (right edge of green field) of the TS-2915/UCC-3(V).			The 8300A indicates +3.6 ±0.18 Vdc.
8	Increase the load current by slowly turning the LOAD ADJ control on TS-3357/TSC-60(V) clockwise until the TS-2915/UCC-3(V) indicates 60 mA.		Adjust potentiometer R27 on the circuit card counterclockwise until the TS-2915/UCC-3 indicates 55 mA (maximum current drain).	The 8300A indicates +3.6 ±0.18 Vdc.
9	Disconnect the 8300A and connect the AN/PSM-6 from the LAMP DRVR test point to the GND test point on the TS-3357/TSC-60(V).	Lamp Driver Q7		The AN/PSM-6 indicates circuit closure to ground.
10	Slowly turn the LOAD ADJ control on the TS-3357/TSC-60(V) to the maximum clockwise position, while observing the meter on the TS-2915/UCC-3(V).			Meter on TS-2915/UCC-3(V) indicates decreasing load current as load is increased. With the LOAD ADJ set to the maximum clockwise position, the meter indicates less than 30 mA.
11	On the TS-3357/TSC-60(V), press the PWR indicator-switch to turn test set power off. Set the LOAD ADJ control to the full counterclockwise position.			The AN/PSM-6 indicates open circuit to ground.
12	Disconnect the test equipment and remove the circuit card under test.			

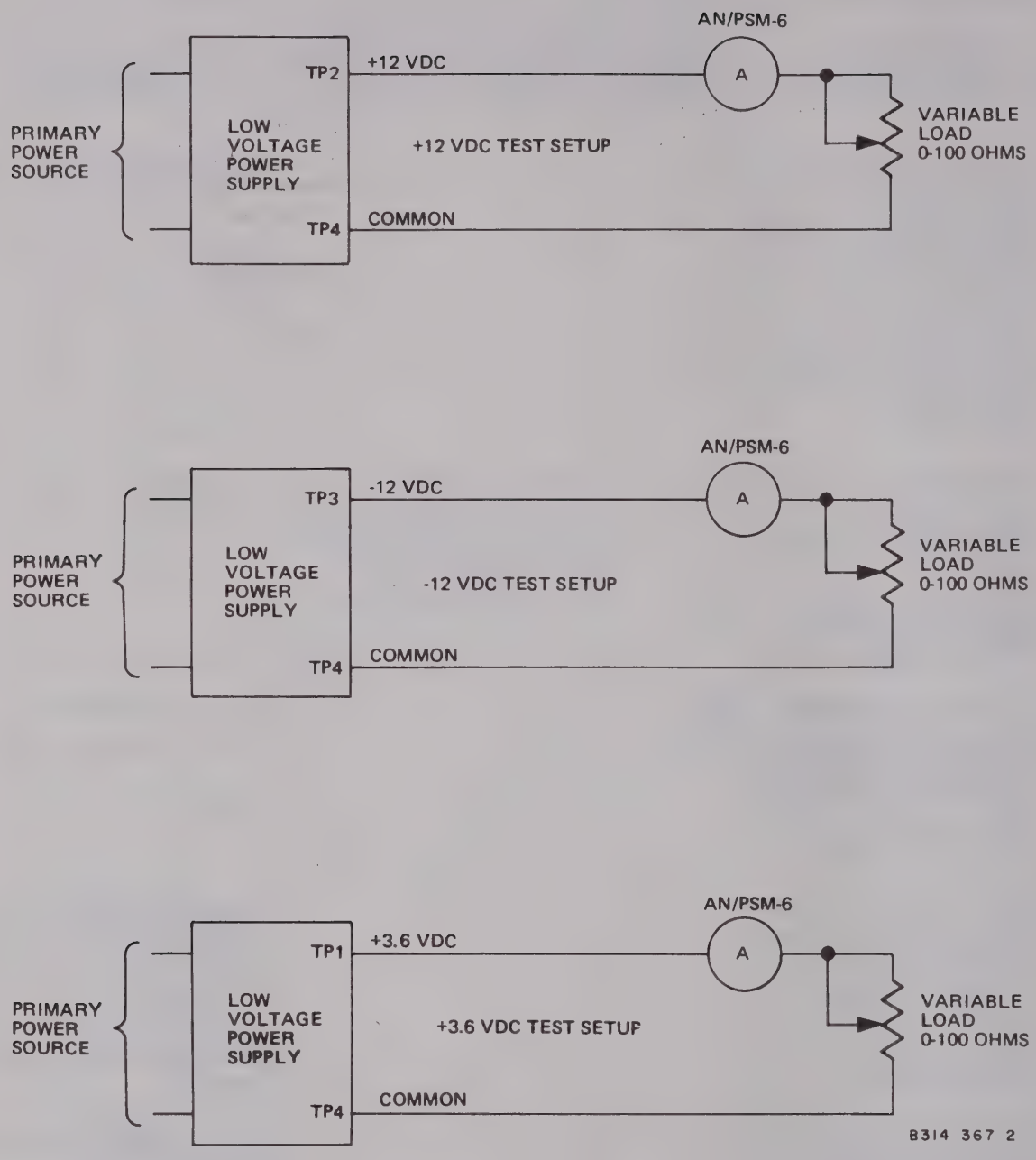


Figure 2-15. AN/UCC-3(V) Low-Voltage Power Supply Test Setup

2-40. COMBINER-POWER SUPPLY CU-1895/UCC-3(V).

2-41. The following paragraphs provide procedures for performance testing the circuit card located in Combiner Panel CU-1895/UCC-3(V). The power supply portion of the CU-1895/UCC-3(V) is tested and adjusted under paragraph 2-31. These procedures require the use of special test equipment that is normally available only at the depot level of maintenance.

2-42. COMBINER AMPLIFIER CIRCUIT CARD PERFORMANCE TEST. Table 2-20 contains the procedure for performance testing the combiner-amplifier circuit card. Perform all steps in table 2-20 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the circuit card is considered to be operational. If the circuit card fails to meet a performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test.

2-43. COMBINER-AMPLIFIER CIRCUIT CARD ADJUSTMENT PROCEDURE. There are no adjustments required for the combiner-amplifier circuit card.

Table 2-20. Combiner-Amplifier Circuit Card Performance Test

TEST EQUIPMENT REQUIRED:

True RMS Voltmeter, HP-3400A
Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V)
Audio Oscillator, HP-209A
Oscilloscope, Tektronix 454
Electronic Frequency Counter, HP-5245L
Electronic Voltmeter, HP-410C

PRELIMINARY INSTRUCTIONS:

Whenever the circuit card fails to meet any portion of the performance test, refer to T.O. 31S1-2TSC60-3 the schematic diagram and the test point data contained there; then use standard troubleshooting techniques to locate the faulty component.

Before probing any test points on the circuit card or before unsoldering or soldering any connections, the postcoating applied to the circuit card must be removed from the point where the work is to be performed.

Always check to be sure that power is removed from the test set before installing or removing a circuit card.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
			TRANSMIT SECTION TEST	
1	Set up the TS-3357/TSC-60(V) as follows: Press the PWR indicator-switch to turn power off. Install the combiner-amplifier card in the test connector. Set the AUDIO NO 1 IN switch to COMB. Connect the HP-209A and HP-5245L to the AUDIO NO 1 IN jack through the bunching jacks. Set the COMBINER-INPUT switch to CH-1.			

Table 2-20. Combiner-Amplifier Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	Connect the HP-3400A and 454 to the AUDIO NO 1 OUT jack. Set the AUDIO NO 1 OUT switch to COMB. Press the PWR indicator-switch to turn the test set power on.			
2	Temporarily patch the HP-3400A to the bunching jacks; adjust the HP-209A for 0 dB at 400 Hz and set the COMBINER-OUTPUT switch to TX A.			The HP-3400A connected to the AUDIO NO 1 OUT jack indicates +11.0 ±1.0 dB. There is no indication of clipping in the waveform displayed by the 454.
3	Change the COMBINER-OUTPUT switch setting to TX B.			Same as step 2.
4	Repeat steps 2 and 3 for each position (CH 2 through CH 18) of the COMBINER-INPUT switch.			The output levels should not vary more than 0.5 dB from step 2.
5	Set the COMBINER-INPUT switch to CH 1 and the COMBINER-OUTPUT switch to TX A.			
6	Slowly vary the output frequency of the HP-209A over the range of 300 Hz to 3400 Hz.			The indication on the 3400A connected to the AUDIO NO 1 OUT jack varies no more than 0.5 dB over the input frequency range.
7	Repeat steps 5 and 6 with the COMBINER-OUTPUT switch set to TX B.			Same as step 6.

Table 2-20. Combiner-Amplifier Circuit Card Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
8	Set the COMBINER-INPUT switch to CH3 and the COMBINER-OUTPUT switch to TX A.			
9	Repeat step 6.			Same as step 6.
10	Repeat steps 8 and 9 with the COMBINER-OUTPUT switch set to TX B.			Same as step 6.
	RECEIVE SECTION TEST			
11	Set up the TS-3357/TSC-60(V) as described in step 1, except as follows: Set the COMBINER-INPUT switch to FSK RCV. Set the COMBINER-OUTPUT switch to RX A.			
12	Temporarily patch the HP-3400A and 454 to the bunching jacks; adjust the HP-209A for -5 dB at 1000 Hz.			The HP-3400A connected to AUDIO NO 1 OUT jack indicates +12 ±1.0 dB. There is no indication of clipping in the waveform displayed by the 454.
13	Repeat steps 11 and 12, except with the COMBINER-OUTPUT switch set to RX B.			Same as step 12.
14	Slowly vary the output frequency of the HP-209A over the range of 300 Hz to 3400 Hz.			The indication on the 320A connected to the AUDIO NO 1 OUT jack varies no more than 0.5 dB over the input frequency range.
15	Repeat step 14, except with the COMBINER-OUTPUT switch set to RX A.			Same as step 14.

2-44. TS-2915/UCC-3(V) TEST SET.

2-45. The following paragraphs provide procedures for performance testing and adjustment of the circuits contained on the test set circuit card. These procedures require the use of special test equipment that is normally available only at the depot level of maintenance.

2-46. TEST SET CIRCUIT CARD PERFORMANCE TEST. Table 2-21 contains the procedures for performance testing the test set circuit card. Perform all steps in table 2-21 in the order presented. Continue through the numbered steps until a malfunction is discovered or until the test is completed. When the entire test can be conducted with no malfunctions, the circuit card is considered to be operational. If the circuit card fails to meet any performance standard, use standard troubleshooting techniques to isolate the faulty component. After any repair, perform the entire performance test. Figure 2-16 shows the TS-2915/UCC-3(V) meter test setup.

2-47. TEST SET CIRCUIT CARD ADJUSTMENT PROCEDURES. The dot cycle generator circuit on the test set circuit card requires adjustment when the output frequency is determined to be out of tolerance. The adjustment procedures consist of trimming fixed value resistor R18 in the circuit of dot cycle oscillator stage A1. Therefore, it is recommended that the procedures of table 2-21 be performed first in order to determine the requirement for adjustment.

a. Set the POWER switch on the front panel of the TS-2915/UCC-3(V) to OFF.

b. Disconnect the circuit card from the test set and remove resistor R18 from the circuit board by clipping the leads as close as possible to the resistor body. Refer to the illustrated parts breakdown of T.O. 33D7-26-6-2 for the physical location of resistor R18 on the circuit card. The leads of R18 that are left on the circuit card by clipping out the resistor shall be used during the adjustment procedure to attach the RA TUNING potentiometer on TS-3357/TSC-60(V) test set. Remove the postcoating from these leads to ensure a proper electrical connection.

c. Extend the circuit card from the test set, using the MX-9441/TSC-60(V) card extender.

d. Connect a set of test leads from jacks 1 and 2 of the RA TUNING potentiometer on the TS-3357/TSC-60(V) to thy leads of resistor R18 on the circuit card.

e. Connect the HP-5245L frequency counter to the DOT GEN output jack on the front panel of the TS-2915/UCC-3(V).

f. Set the POWER switch on the TS-2915/UCC-3(V) to ON.

g. Adjust the RA TUNING potentiometer on the TS-3357/TSC-60(V) for an indication of 37.5 ±0.1 Hz on the HP-5245L.

h. Record the value indicated by the dial of the RA TUNING potentiometer in step g.

i. Refer to the resistor selection chart in the illustrated parts breakdown in T.O. 33D7-26-6-2. From this chart select the resistance value closest to the value recorded in step h.

j. Set the RA TUNING potentiometer to the exact resistor value selected in step i. If the HP-5245L indicates 37.5 ±1.0 Hz, the stage is properly tuned and the resistance value selected in step i. should be installed.

Table 2-21. Teletypewriter Test Set TS-2915/UCC-3(V) Performance Test

TEST EQUIPMENT REQUIRED:

Electronic Circuit Plug-In Unit Test Set TS-3357/TSC-60(V)
Test Set TS-2915/UCC-3(V)
Audio Oscillator, HP-209A
True RMS Voltmeter, HP-3400A
Electronic Voltmeter, HP-410C
Digital Voltmeter, Fluke 8300A
Electronic Frequency Counter, HP-5245L
Multimeter AN/PSM-6
Oscilloscope, Tektronix 454
Power Supply, HP-6104A or equivalent
Current-limiting resistor, 100-ohm, 2-watt
Delay Diversity Circuit Card (Part of FSK Channel Unit)
Electronic Test Extender Card MX-9441/TSC-60(V)
Power Input Cable, locally fabricated (See preliminary instructions.)

PRELIMINARY INSTRUCTIONS:

Fabricate a power input cable for maintenance, using connector type MS3106R-14S-7S (or equivalent) and a 3-prong plug for mating with the local ac power receptacles. Connect the cable to the connector for 120 Vac on pin A, 120 Vac return on pin C, and power ground on pin B.

Before attempting to probe any test points or before attempting to unsolder or solder any connections, and the postcoating applied to the circuit card must be thoroughly removed from the solder pad where the work is to be performed.

If the circuit card fails to meet any portion of the performance test, refer to the schematic diagram in T.O. 33D7-26-6-2, and use standard troubleshooting techniques to locate the faulty component.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
		POWER SUPPLY CIRCUITS TEST		
1	Extend power supply circuit card (A2) with the MX-9441/TSC-60(V).		Connect ac power to the TS-2915/UCC-3(V) test set. Set the POWER switch to ON.	POWER indicator turns on.
2	Connect the AN/PSM-6 between the GRD and -12V front panel test points.	P1-18		The AN/PSM-6 indicates -12 ±1.2 Vdc.
3	Connect the AN/PSM-6 between the GRD and +12V front panel test points.	P1-21		The AN/PSM-6 indicates +12 ±1.2 Vdc.
4	Connect the AN/PSM-6 between the GRD and +3V front panel test points.	P1-19		The AN/PSM-6 indicates +3.6 ±0.36 Vdc.

Table 2-21. Teletypewriter Test Set TS-2915/UCC-3(V) Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5	If the indications obtained in steps 2 through 4 are not as specified, refer to the power supply circuit card schematic diagram in T.O. 33D7-26-6-2, and check the voltage at the transistor terminals using the HP-3400A.			Voltages present at transistor terminals are as listed in the voltage table on the schematic diagram.
	VU METER CIRCUIT TEST			
6	Extend test set circuit card (A1) with the MX-9441/TSC-60(V)			
7	Connect the HP-209A to the ATTENUATION INPUT jack on the front panel of the TS-2915/UCC-3(V) under test. Connect the ATTENUATION OUTPUT jack to the 600-ohm input jack of the TS-2915/UCC-3(V) under test. Set the ATTENUATION control to 0 dB.			
8	Connect the HP-5245L and HP-3400A to monitor the output of the HP-209A. Adjust the HP-209A output for +14 dBm at 1000 Hz. Connect the HP-410C to P1-1 on the circuit card.		Set the RANGE switch to +10. Adjust the CAL potentiometer for an indication of 1.2 volts rms on the HP-410C connected to P1-1 on the circuit card.	AUDIO TONE LEVEL meter indicates 0 ±1 vu.
9	Set the ATTENUATION control to 10 dB.	P1-1	Set the RANGE switch to 0	AUDIO TONE LEVEL meter indicates 0 ±1 vu. The HP-410C connected to P1-1 indicates 1.2 volts rms, ±0.1 volt.

Table 2-21. Teletypewriter Test Set TS-2915/UCC-3(V) Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
10	Set ATTENUATION control to 20 dB.	P1-1	Set the RANGE switch to -10	AUDIO TONE LEVEL meter indicates 0 ±1 vu. The HP-410C connected to P1-1 indicates 1.2 volts rms, ±0.1 volt.
11	Set ATTENUATION control to 30 dB.	P1-1	Set the RANGE switch to -20	AUDIO TONE LEVEL meter indicates 0 ±1 vu. The HP-410C connected to P1-1 indicates 1.2 volts rms, ±0.1 volt.
12	Set ATTENUATION control to 40 dB.	P1-1	Set the RANGE switch to -30	AUDIO TONE LEVEL meter indicates 0 ±1 vu. The HP-410C indicates 1.2 volts rms, ±0.1 volt.
13	Set ATTENUATION control to 50 dB.			AUDIO TONE LEVEL meter indicates -10 ±1 vu.
14	Set the ATTENUATION control to 60 dB.			AUDIO TONE LEVEL meter indicates -20 ±2 vu.
	DELAY METER CIRCUIT TEST			
	NOTE In the test that follows, two signal sources are required; one delayed from the other from 0 to 250 microseconds. A UCC-3 delay/diversity circuit card, (part number 773-9888-001) known to be in proper operating condition is installed on the TS-3357/TSC-60(V) and is used to provide the variable delay signal.			

Table 2-21. Teletypewriter Test Set TS-2915/UCC-3(V) Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
15			Set the FUNCTION switch on the TS-2915/UCC-3(V) to 25 MA.	The FSK CHANNEL TEST meter indicates 0 ±10% of full-scale deflection.
16	Press the PWR indicator-switch on the TS-3357/TSC-60(V) to turn power off. Install a delay/diversity circuit card in the delay/diversity test connector of the TS-3357/TSC-60(V). Connect the DOT GEN output jack of a TS-2915/UCC-3(V), known to be in proper operating condition, to the bunching jacks of the TS-3357/TSC-60(V). Connect a patch cord from the bunching jacks to the INPUT DATA DIR jack of the TS-3357/TSC-60(V). Set the INHB switch to OFF. Set the DATA STATE switch of the TS-3357/TSC-60(V) to DATA. Set the INPUT DATA switch on the TS-3357/TSC-60(V) to DELAY. Set the OUTPUT DATA switch of the TS-3357/TSC-60(V) to DELAY DATA. Connect a patch cord from the OUTPUT DATA jack on the TS-3357/TSC-60(V) to the DIVERSITY input jack on the TS-2915/UCC-3(V) under test.			

Table 2-21. Teletypewriter Test Set TS-2915/UCC-3(V) Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
16 (Cont)	Connect a patch cord from the bunching jacks on the TS-3357/TSC-60(V) to the MAIN DIFF DELAY INPUT jack of the TS-2915/UCC-3(V) under test. Connect the 454 channel A input to the bunching jacks on the TS-3357/TSC-60(V). Connect the 454 channel B input to monitor the signal at the OUTPUT DATA jack of the TS-3357/TSC-60(V). Press the PWR indicator-switch on the TS-3357/TSC-60(V) to turn power on.			
17	Connect the 8300A to P1-38 of the TS-2915/UCC-3(V) circuit card under test.		Set FUNCTION switch on the TS-2915/UCC-3(V) to 75 MA.	
18	Observing the 454 channel A and B waveforms, adjust the DATA DELAY control on the TS-3357/TSC-60(V) for minimum delay between the two square-wave patterns.	P1-38		With minimum delay between the 454 channel A and channel B waveforms, the 8300A indicates 0 ±0.10 Vdc.
19	Observing the 454, adjust the DATA DELAY control on the TS-3357/TSC-60(V) so that the channel B waveform lags the channel A waveform by 50 microseconds.	P1-38		The 8300A indicates +0.20 ±0.02 Vdc.

Table 2-21. Teletypewriter Test Set TS-2915/UCC-3(V) Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
20	Repeat step 19, adjusting for a delay of 100 microseconds.	P1-38		The 8300A indicates +0.40 ±0.04 Vdc.
21	Repeat step 19, adjusting for a delay of 150 microseconds.	P1-38	Adjust R25 on A1 card, if required, for proper indication.	The 8300A indicates +0.60 ±0.05 Vdc.
22			Set FUNCTION switch on the TS-2915/UCC-3(V) to DELAY.	Observe that delay meter indicates within green portion of scale. (Adjust R25 on circuit card A1 if required.)
23	Repeat step 19, adjusting for a delay of 200 microseconds.	P1-38	Set FUNCTION switch on the TS-2915/UCC-3(V) to 75 MA.	The 8300A indicates +0.80 ±0.1 Vdc.
	DOT CYCLE GENERATOR CIRCUIT TEST			
24	Connect the 454 and the HP-5245L to the DOT GEN output jack on the front panel of the TS-2915/UCC-3(V) under test.	J10		The HP-5245L indicates 37.5 ±0.1 Hz. The 454 display is a symmetrical square wave with levels of 0.25 ±0.25 and 3.0 ±0.5 Vdc. NOTE If the frequency of the dot generator is out of tolerance, the frequency must be adjusted by trimming the value of fixed resistor R18 in the circuit. Refer to the adjustment procedures in paragraph 2-45.
	ATTENUATOR TEST			
25	Connect the HP-209A to the ATTENUATION INPUT jack. Connect the HP-5245L to monitor the output frequency of the HP-209A.		Set the ATTENUATION control of the TS-2915/UCC-3(V) under test to 0.	

Table 2-21. Teletypewriter Test Set TS-2915/UCC-3(V) Performance Test (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
25 (Cont)	Connect the ATTENUATION OUTPUT jack to the bunching jacks on the TS-3357/TSC-60(V). Connect a 600-ohm dummy load to the bunching jacks. Connect the HP-410C to the bunching jacks. Adjust the HP-209A to obtain an indication of +20 dB on the HP-410C and 1000 Hz on the HP-5245L.			
26			Set the ATTENUATION control to each position, 2 through 60, and verify the HP-410C indication at each position.	The HP-410C indicates that the input signal is attenuated in 2-dB steps (±1 dB) as the ATTENUATION control is set to positions 2 through 60.
	DC MICROAMMETER TEST			
27	Connect the test setup as shown in figure 2-16.		Set the FUNCTION switch to 25 MA.	
28	Adjust the output of HP-6104A to 0.020 ampere at +5 Vdc.			The FSK CHANNEL TEST meter indicates 20 ±2.0 milliamperes.
29			Set the FUNCTION switch to 75 MA.	
30	Adjust the output of the HP-6104A to 0.060 ampere at +5 Vdc.			The FSK CHANNEL TEST meter indicates 60 ±5.0 milliamperes.

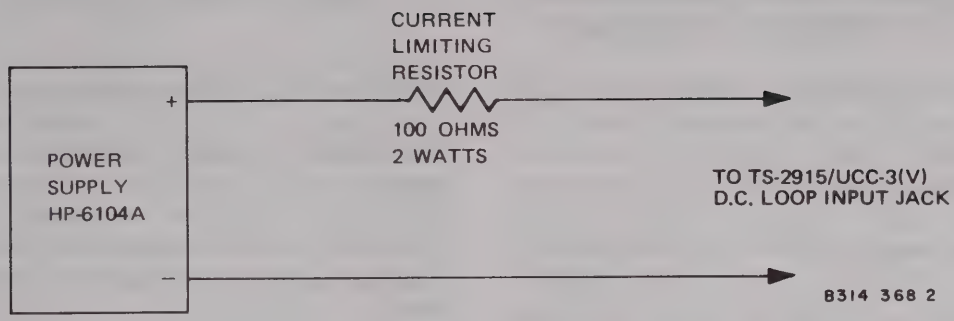


Figure 2-16. TS-2915/UCC-3(V) Meter Test Setup

2-48. ELECTRICAL FREQUENCY SYNTHESIZER O-1560/GR (887B-1).

2-49. The following paragraphs provide instructions for special maintenance procedures on Electrical Frequency Synthesizer O-1560/GR (887B-1). Follow the instructions in the following paragraphs as a step-by-step procedure. The test equipment required is listed in paragraph 2-49. Other useful information concerning 887B-1 testing can be found in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12.

2-50. The following test equipment is required for special maintenance of the 887B-1.

a. Frequency Standard O-1612/URC

b. Electrical Special Purpose Cable Assembly CS-12770/TSC-60(V) (887B-1 Extender Cable)

c. Oscilloscope, Tektronix 454

d. Communication Central Training Set AN/TSC-60(V)1-T2.

2-51. Set up the equipment as described below.

a. Extend the 887B-1 under test from Communication Central Training Set AN/TSC-60(V)1-T2 with the CX-12770/TSC-60(V) extender cable.

b. Energize the AN/TSC-60(V)1-T2 and allow the 887B-1 to warm up for 30 minutes.

c. Energize Frequency Standard O-1612/URC, set it for 100-kHz output, and allow it to warm up as long as required in its instruction book.

d. Connect the O-1612/URC 100-kHz output and 887B-1 P1-131 to the vertical and horizontal inputs on the 454 oscilloscope.

e. Adjust the 454 for a Lissajous pattern. A Lissajous pattern that inverts itself less than once per 1000 seconds indicates the 887B-1 frequency standard is within the specification of 1 x 10^{-9} accuracy.

f. If only slightly out of specification, adjust A22C29 (for A22 part number 609-0699-001) or A22R29 (for A22 part number 777-4308-001). Wait 5 minutes for stabilization after each adjustment.

g. If quite a bit of adjustment is required, adjust A22R13 (for A22 part number 609-0699-001) or A22R10 (for A22 part number 777-4308-001) slightly and repeat step f. above.

2-52. AUDIO FREQUENCY DETECTOR CV-2653/GRR-18(V)1 (889A-2).

2-53. The following paragraphs provide instructions for special maintenance procedures on Audio Frequency Detector CV-2653/GRR-18(V)1 (889A2). Follow the instructions in the following paragraphs as a step-by-step procedure. The test equipment required is listed in paragraph 2-54. Other useful information concerning 889A-2 testing can be found in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12.

2-54. The following test equipment is required for special maintenance of the 889A-2.

a. Distortion Analyzer AN/USM-259 (HP-333A)

b. Electrical Special Purpose Cable Assembly CX-12767/TSC-60(V) (889A-2 Extender Cable)

c. Communication Central Training Set AN/TSC-60(V)1-T2

d. HF Signal Generator, HP-606A

e. Impedance Matching Network CU-1986/TSC-60(V)

2-55. Check the 889A-2 total harmonic distortion as follows:

a. Set up the equipment for A2 mode as shown in figure 2-17. Set the HP-606A signal generator to 255.29 kHz at 60 mV.

b. Select A2 VOICE mode in receive.

c. Measure and record total distortion with the AN/USM-259 distortion analyzer at 1000 Hz.

d. Total distortion should not exceed 0.5 percent.

e. Set up the equipment for B2 mode as shown in figure 2-17. Set the HP-606A to 244.71 kHz at 60 mV.

f. Select B2 VOICE in receive.

g. Repeat steps c. and d.

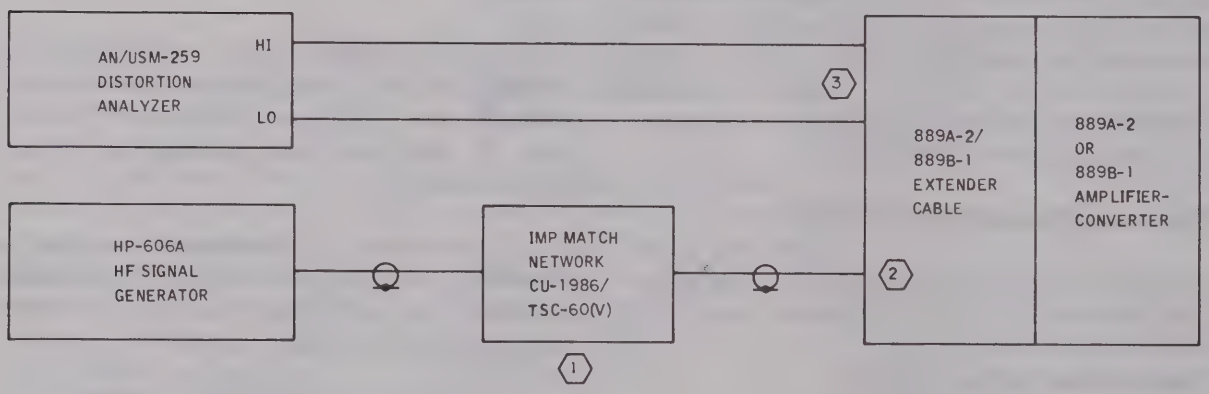


Figure 2-17. 889A-1/889B-1 Audio Distortion Test Setup Block Diagram

2-56. AUDIO FREQUENCY DETECTOR CV-2652/GRR-18(V)1 (889B-1).

2-57. The following paragraphs provide instructions for special maintenance procedures on Audio Frequency Detector CV-2652/GRR-18(V)1 (889B-1). Follow the instructions in the following paragraphs as a step-by-step procedure. The test equipment required is listed in paragraph 2-58. Other useful information cncerning 889B-1 testing can be found in T.O. 31S1-2TSC60-2 and in T.O. 31S1-2TSC50-12.

2-58. The following test equipment is required for special maintenance of the 889B-1.

a. Distortion Analyzer AN/USM-259 (HP-333A).

b. Electrical Special Purpose Cable Assembly CX-12767/TSC-60(V) (889B-1 Extender Cable).

c. Communication Central Training Set AN/TSC-60(V)1-T2.

d. HF Signal Generator, HP-606A.

e. Impedance Matching Network CU-1986/TSC-60(V)

2-59. Check the 889B-1 total harmonic distortion as follows:

a. Set up the equipment for A1 mode as shown in figure 2-17. Set the HP-606A signal generator to 251 kHz at 30 mV.

b. Select A1 VOICE mode in receive.

c. Measure and record total distortion with the AN/USM-259 distortion analyzer at 1000 Hz.

d. Total distortion should not exceed 0.5 percent.

e. Switch to AM mode in receive and change the HP-606A to 250 kHz at 50 mV modulated 30 percent at 1000 Hz.

f. Repeat step c. Total distortion should not exceed 2 percent.

g. Set up the equipment for B1 mode as shown in figure 2-17 Set the HP-606A to 249 kHz at 30 mV.

h. Select B1 VOICE mode in receive.

i. Repeat steps c. and d.

2-60. AMPLIFIER-CONVERTER CV-2651/GRR-18(V)1 (888B-2).

2-61. The following paragraphs provide instructions for special maintenance procedures on Amplifier-Converter CV-2651/GRR-18(V)1 (888B-2). Follow the instructions in the following paragraphs as a step-by-step procedure. The test equipment required is listed in paragraph 2-62. Other information concerning 888B-2 testing can be found in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12. For an alternate method of testing the 888B-2 using the TS-3786/TSC-60(V) Fault Locator refer to T.O. 33D7-25-43-1.

2-62. The following test equipment is required for special maintenance of the 888B-2.

a. Electrical Special Purpose Cable Assembly CX-12771/TSC-60(V) (888B-1/888B-2 Extender Cable)

b. Communication Central Training Set AN/TSC-60(V)1-T2

c. HF Signal Generator, HP-606A

d. VHF Signal Generator MIL-G-38712 (HP-608)

e. Resistor, 200-ohm, 1/2-watt

f. Variable Attenuator, HP-355C

g. True RMS Voltmeter, HP-3400A

h. Electronic Frequency Counter, HP-5245L

i. RF Millivoltmeter, Ballantine 340

2-63. Check the 888B-2 first if. image response and first if. rejection as follows:

a. Set up the equipment as shown in figure 2-18 except use HP-608 signal generator.

b. Connect rf voltmeter to RECEIVER A1 OUT jack on audio jackfield 1A5.

c. Select 29.9980 MHz, channel A1 VOICE mode on the HF RCVR control.

d. Set HP-608 to 29.999 MHz at 2μV.

e. Record audio level indicated on rf voltmeter for reference.

f. Set the HP-608 to exactly 188.301 MHz and increase the HP-608 level to obtain reference audio level of step e.

g. The HP-608 input level required should be no less than 90 dB higher than 2μV (if. image response).

h. Tune receiver to 2.0000 MHz.

i. Connect the HP-606A signal generator in place of the HP-608.

j. Set the HP-606A to 2.001 MHz at 2μV and record the audio level for reference.

k. Connect the HP-608 in place of the HP-606A.

l. Set the HP-608 for 109.150 MHz and increase the HP-608 level until the audio reference of step i. is obtained.

m. The HP-608 input level required should be no less than 90 dB higher than 2μV (first if. rejection).

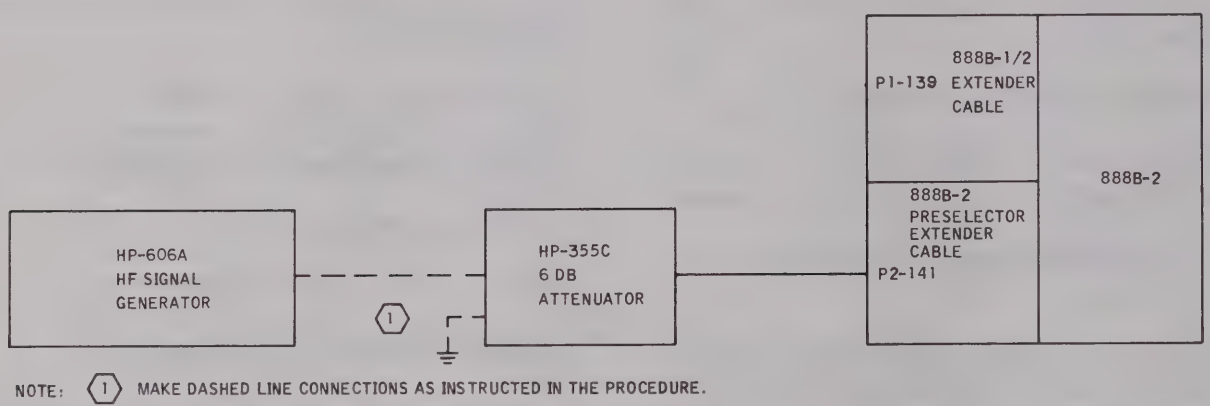


Figure 2-18. 888B-2 Spurious Signals Test Setup Block Diagram

2-64. RADIO TEST SET TS-2923/GRR-18(V)1 (599H-3).

2-65. The following paragraphs provide instructions for special maintenance procedures on Radio Test Set TS-2923/GRR-18(V)1 (599H-3). Follow the instructions in the following paragraphs as a step-by-step procedure. The test equipment required is listed in paragraph 2-66. Other information concerning 599H-3 testing can be found in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC60-12.

2-66. The following test equipment is required for special maintenance of the 599H-3.

a. Electrical Special Purpose Cable Assembly CX-12769/TSC-60(V) (599H-3 Extender Cable)

b. RF Switching Unit SA-1914/TSC-60(V)

c. HF Signal Generator, HP-606A

d. Variable Attenuator, HP-355C

e. Radio Receiver, Collins 51S-1

f. Communication Central Training Set AN/TSC-60(V)1-T2

2-67. Check the high- and low-level self-test rf output of the 599H-3 as follows:

a. Connect the HP-606A (set at 2 MHz) through the HP-355C (set for 6 dB) to RF 1 IN jack of SA-1914/TSC-60(V).

b. Extend 599H-3 from the AN/TSC-60(V)1-T2 using the CX-12769/TSC-60(V) extender cable.

c. Connect P1-153 of the CX-12769/TSC-60(V) to RF2 IN on SA-1914/TSC-60(V).

d. Connect SA-1914/TSC-60(V) RF OUT jack to 51S-1 receiver ANT jack.

e. Set SA-1914/TSC-60(V) to RF 1 OFF mode and POWER to ON.

f. Set 51S-1 receiver to USB at 2 MHz with meter switch in extreme right position, the rf gain approximately three-quarters full clockwise, and the audio gain approximately three-quarters full clockwise.

g. Enable the AN/TSC-60(V)1-T2 in receive channel A1 self-test at 2 MHz.

h. Vary the 51S-1 frequency control to find the peak indication as shown on the 51S-1 "S" meter. Then go above and below this frequency about 1 kHz to find the average level (this is to allow for ripple in the bandpass).

i. Set the 51S-1 frequency control as near 2 MHz as possible with the "S" meter at the average level (from step h.).

j. Set the SA-1914/TSC-60(V) to MEDIUM.

k. Find the HP-606A output level that holds the 51S-1 "S" meter indication steady or equal to the level of 599H-3 output alone. The HP-606A output should be 1.0 mV minimum.

l. Repeat at 5, 10, 15, 20, 25, and 29 MHz.

m. Ground CX-12769/TSC-60(V) extender pin P1-128 (self-test low) and repeat entire procedure. The HP-606A output should be 2.5 μV minimum for the low-level self-test.

n. Adjust A7R25 for best balance between high- and low-level self-test results if necessary.

2-68. POWER SUPPLY PP-4992/ARC-132 (652J-4).

2-69. The following paragraphs provide instructions for special maintenance procedures on Power Supply PP-4992/ARC-132 (652J-4). Follow the instructions in the following paragraphs as a step-by-step procedure. The test equipment required for special maintenance of the 652J-4 is listed in paragraph 2-70. Other information concerning testing of the 652J-4 can be found in T.O. 31S1-2TSC60-2 and T.O. 31S1-2TSC-12.

2-70. The following test equipment is required for special maintenance of the 652J-4:

a. Electrical Special Purpose Cable Assembly CX-12774/TSC-60(V) (652J-4 Extender Cable)

b. Electronic Equipment Air Cooler HD-906/TSC-60(V)

c. Electrical Dummy Load DA-653/TSC-60(V) (172S-1 Dummy Load)

d. Digital Voltmeter, Fluke 8300A

e. Electronic Frequency Counter, HP-5245L

f. Oscilloscope, Tektronix 454

2-71. Check the rated outputs of the 652J-4 as follows:

NOTE

All dc voltages with respect to chassis ground.

a. Set up the equipment as shown in figure 2-19. Set all 172S-1 load switches to MIN, and LOW VOLTAGE ENABLE switch to OFF.

b. Connect the 172S-1 and the HD-906/TSC-60(V) to 115V, 60 Hz and set POWER switches to ON.

c. The +5 Vdc continuous at P1-55 and +20 Vdc at P1-50 should be present, and voltages at P1-1, 5, 7, 9, 15, 53, and 63 should not be present.

d. Hold the 5V CONT switch to MAX and check level at P1-55 with the 8300A. It should be less than +4 Vdc.

e. Set the 5 VDC CONT switch to NOM, and hold the 20V CONT switch to MAX.

f. The level at P1-50 should be less than +18 Vdc. Set the 20V CONT switch to NOM.

g. Hold the 20 VDC SWITCHED switch to MAX, set the LOW VOLTAGE ENABLE switch to ON, and check the level at P1-1. It should be less than +18 Vdc.

h. Set the 20 VDC SWITCHED switch to MIN and hold the -20 VDC SWITCHED switch to MAX.

i. Check the level at P1-63; it should be less than -18 Vdc (-17.9 is good, etc.).

j. Set the -20 VDC SWITCHED switch to MIN and hold the 9 VDC SWITCHED switch to MAX.

k. Check the level at P1-7; it should be less than +8 Vdc.

l. Set the 9 VDC SWITCHED switch to MIN and hold the -8 VDC SWITCHED switch to MAX.

m. Check the level at P1-9; it should be less than -7 Vdc (-6.9 Vdc is good, etc.).

n. Set the -8 VDC SWITCHED switch to MIN and hold the 5 VDC SWITCHED switch to MAX.

o. Check the level at P1-53; it should be less than +4 Vdc.

p. Set the 5 VDC SWITCHED switch to MIN, and hold the 27 VDC SWITCHED switch to MAX.

q. Check the level at P1-5; it should be less than +24 Vdc.

r. Set the 27 VDC SWITCHED switch to MIN.

s. Set the 200 VDC SWITCHED switch to MIN, and the 115 VAC 400 HZ switch to NOM.

t. Check the level at P1-69; it should be at least 110 Vac. Check the frequency at P1-69; it should be 350 to 440 Hz.

u. Set all load switches to NOM and check the levels at the following pins for the listed levels:

P1-1	+19.7 to +20.3 Vdc
P1-5	+26.6 to +29.5 Vdc
P1-7	+8.8 to +9.2 Vdc
P1-9	-7.8 to -8.2 Vdc
P1-50	+19.7 to +20.3 Vdc
P1-53	+4.75 to +5.25 Vdc
P1-55	+4.75 to +5.25 Vdc
P1-63	-19.7 to -20.3 Vdc

v. Check all pins listed below for ripple content with the 454 oscilloscope (ignore spikes).

P1-1	No more than 40 mV p-p
P1-5	No more than 2 V p-p
P1-7	No more than 40 mV p-p
P1-9	No more than 40 mV p-p
P1-15	No more than 400 mV p-p
P1-50	No more than 40 mV p-p
P1-53	No more than 400 mV p-p
P1-55	No more than 400 mV p-p
P1-63	No more than 40 mV p-p

w. Check dc level at P1-59 to ground; it should be less than +1 Vdc (logic 0).

x. Set LOW VOLTAGE ENABLE switch to OFF and check the level at P1-59; it should be +2.4 to +5.1 Vdc (logic 1).

2.71A. ← Add 05-1

fig 2-18a
fig 2-18b
fig 2-18c

See TP-1

2-72. 309H-1 ANTENNA COUPLER CONTROL AND 490X-1 ANTENNA COUPLER.

2-73. The following paragraphs provide instructions for special maintenance of the 309H-1 Antenna Coupler Control and the 490X-1 Antenna Coupler as a subsystem.

2-74. The special maintenance procedure is presented in table 2-22 and the required test equipment is listed in the beginning of table 2-22.

2-75. 490X-1 ANTENNA COUPLER. The following paragraphs provide special maintenance for 490X-1 Antenna Coupler. Instructions are provided to check the operation of the 490X-1 using the 878L-42 Antenna Coupler Test Set (part of the 980H-13 Antenna Coupler Test Set). The 980H-13 Antenna Coupler Test Set is a special test set designed to aid in testing and troubleshooting the 490X-1 Antenna Coupler, the discriminator module from the 490X-1 Antenna Coupler, and the 309H-1 Antenna Coupler Control. For information on the 980H-13 refer to Technical Manual for Antenna System Test Set AN/TSM-130 (980H-13), T.O. 33AA40-3-12.

2-76. The maintenance procedure is presented in table 2-23 and the required test equipment is listed in paragraph 2-77.

2-77. The following test equipment is required for special maintenance of the 490X-1.

a. Antenna System Test Set TS-3361/T (878L-42 Antenna Coupler Test Set)

b. Stopwatch, Meylan 202A (or equivalent)

c. Crank, Collins part number 790-2240-001

2-78. Removal and replacement procedures are provided for each subassembly of the 490X-1. For location of subassemblies and attaching hardware refer to the IPB of T.O. 31S1-2TSC60-32. Mark screws, washers, and other common hardware as they are removed to ensure proper reassembly.

CAUTION

Ensure that the power cable is disconnected from the 490X-1 before disassembling any portion of the equipment.

2-79. To remove the 490X-1 from the case, proceed as follows:

a. Loosen the 18 captive screws that secure the cover to the baseplate and remove the cover.

b. Remove the 18 screws from each chassis cover and lift off the two covers.

2-80. To replace the 490X-1 in the case, proceed as follows:

a. Replace the two chassis covers and secure with the 18 screws for each cover.

b. Slide the 490X-1 into the cover and perform the following sealing instructions. These instructions are also listed on decals attached to the covers of the 490X-1 and 309H-1.

1. Clean gaskets; replace if necessary.

2. Oil threads of holddown screws with a light machine oil.

3. Using a No. 2 Phillips screwdriver, apply maximum torque to screws. Approximately 1-5/8 turn of screws will be required.

2-81. To remove the discriminator module from the 490X-1 proceed as follows:

a. Remove the 490X-1 as explained in paragraph 2-79.

b. Disconnect the rf output from the discriminator by removing the nut and lockwasher that secure the rf terminal lug to the rf terminal of the discriminator.

c. Remove the screw and lockwasher that fasten the discriminator to the chassis partition. To aid in removing the screw, there is an access hole in the rear of the 490X-1 chassis.

d. Remove the four screws that fasten the discriminator module to the 490X-1 chassis.

NOTE

Because the input connectors have not been removed, the discriminator module is not free of the chassis. However, the module can be extended enough for most testing purposes.

RESULT OF TCTO

2-118 (Deleted)

RESULT OF TCTO

2-119 (Deleted)

2-82. To replace the discriminator module in the 490X-1 proceed as follows:

a. Position the discriminator module in the 490X-1 chassis and secure with four screws.

b. Replace the screw and lockwasher that secure the discriminator module to the chassis partition.

c. Place the rf terminal lug on the rf terminal of the discriminator module and secure with the applicable nut and lockwasher.

d. Replace the chassis covers and case as explained in paragraph 2-80.

2-83. To remove the phasing or loading capacitor assembly proceed as follows:

a. Remove the 490X-1 from the case and the chassis covers from the 490X-1 as explained in paragraph 2-79.

b. Disconnect the rf output from the discriminator module by removing the nut and lockwasher that secure the terminal lug to the discriminator terminal.

c. Loosen the two screws that secure plug P1 or P2 to the applicable capacitor assembly and disconnect the plug from the capacitor assembly.

d. Remove the six screws and lockwashers that attach the loading capacitor ground straps to the 490X-1 chassis.

e. Remove the six screws that secure the left chassis assembly (discriminator side) to the baseplate and remove the chassis from the baseplate.

f. Remove the six screws that attach the applicable capacitor assembly to the chassis. Carefully lift the capacitor assembly from the chassis.

2-84. To replace the phasing or loading capacitor assembly proceed as follows:

a. Position the capacitor assembly on the right side chassis and secure with six screws.

b. Position the left chassis assembly on the baseplate and secure with six screws.

c. Connect the six ground straps to the loading capacitor using six screws and lockwashers.

d. Connect the applicable plug (P1 or P2) to the capacitor assembly just installed and tighten the screws that secure the plug.

e. Position the rf terminal lug on the discriminator terminal and fasten with nut and lockwasher.

f. Replace the chassis cover and case as explained in paragraph 2-80.

WARNING See S...

2-85 Upon Failure of 490X-1 ... Counter ... Housing ...

See OS-2

SEE TP-1

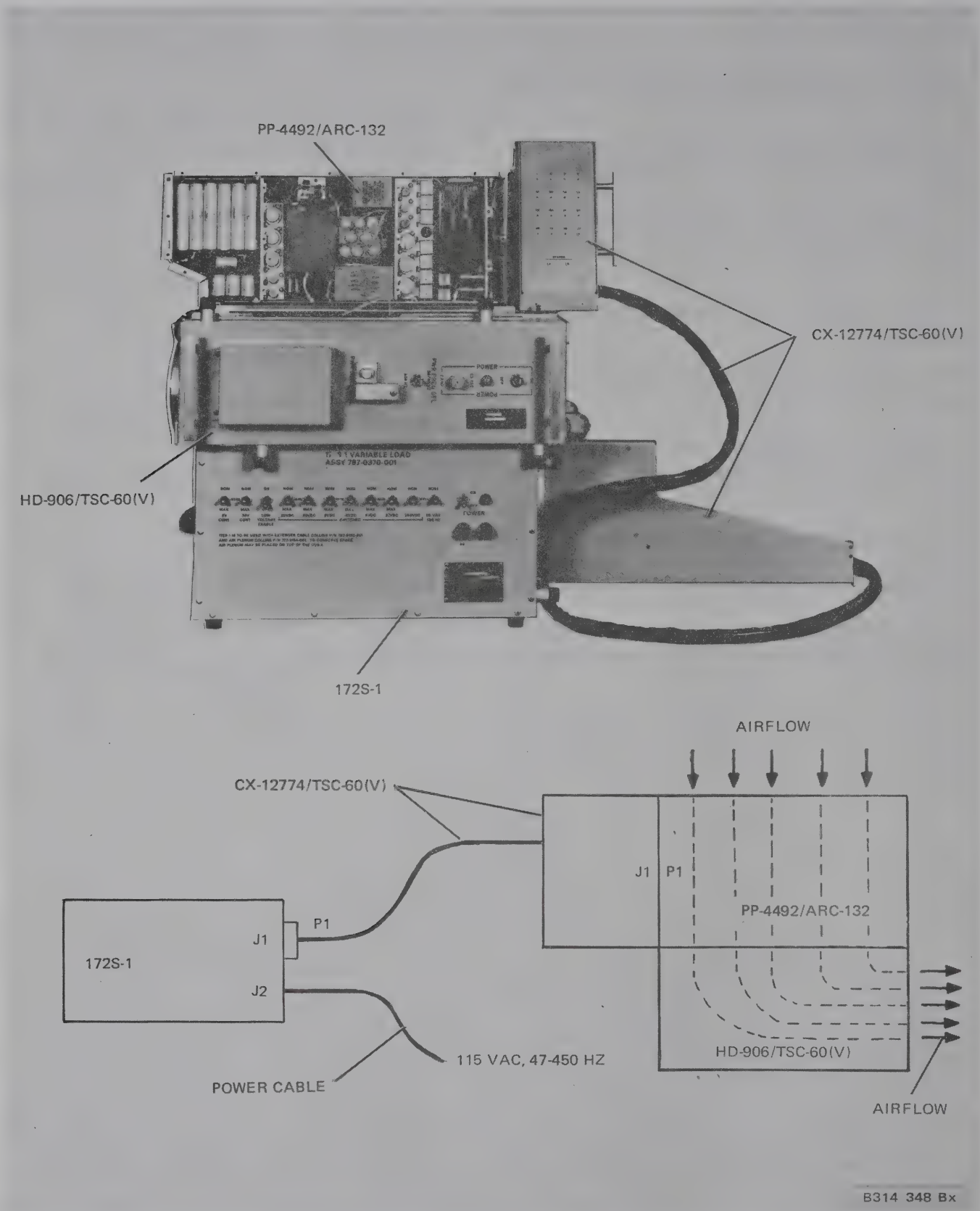


Figure 2-19. 652J-4 Power Supply Test Setup

RESULT OF TCTO (See TP-1 cover page

2-121 Through ~~2-828~~ 2-155 (Deleted)

Table 2-27. Fault Lamps vs Function Selector Power Supply Positions

FUNCTION POSITION	FAULT LAMP			
	1	2	3	4
1	Lights if -12-Vdc level high	Lights if -12-Vdc level low	Lights if -12-Vdc ripple high	Not applicable
2	Lights if +12-Vdc level high	Lights if +12-Vdc level low	Lights if +12-Vdc ripple high	Lights if +28-Vdc not present at 309H-1 J2-d
3	Lights if +5-Vdc level high	Lights if +5-Vdc level low	Lights if +5-Vdc ripple high	Lights if ground not present at 309H-1 J2-d
4	Lights if +28-Vdc level high	Lights if +28-Vdc level low	Lights if +28-Vdc ripple high	Lights if +28 Vdc not present at 309H-1 J2-K (series circuit control)

See TP-1

2-98. ANTENNA COUPLER CU-1896/TSC-60(V)1 (490T-8).

2-99. GENERAL. The following paragraphs provide maintenance instructions for Antenna Coupler CU-1896/TSC-60(V)1, commonly referred to as the 490T-8. Instructions are provided to check overall operational performance of the 490T-8 and the performance standard of each subassembly, with the exception of control cards A9, A10, and A11. The three control cards may be tested using Automatic Test System, Hewlett-Packard 9500A. Antenna Coupler Test Set 980H-12 is a special test set designed to aid in testing and troubleshooting the subassemblies in the 490T-8. For information on the 980H-12 refer to Technical Manual for Antenna System Test Set AN/TSM-129 (980H-12), T.O. 33AA40-3-2.

2-100. Maintenance coverage for each subassembly is on an individual basis. A list of required test equipment is given with the performance test procedure for each individual subassembly. If specified test equipment is not available, equivalent models may be used.

2-101. Removal and replacement procedures are provided for each subassembly. Refer to Technical Manual for Antenna Coupler CU-1896/TSC-60(V)1, T.O. 3181-2TSC60-112, chapter 6, figures 6-1 and 6-16 for location of subassemblies and attaching hardware (where necessary, the item number of the subassembly/component will be called out in the procedures). Mark screws, washers, and other common hardware as they are removed to ensure proper reassembly.

CAUTION

Ensure that the power cable is disconnected from the 490T-8 before disassembling any portion of the equipment. Disassembling the equipment with the power cable connected may cause voltage transients that can damage semiconductor components. During removal or replacement of subassemblies, be sure that both subassembly and chassis are adequately supported to avoid damage to either.

2-102. To remove the 490T-8 from the case proceed as follows:

a. Unplug the external blower (9) from the 490T-8.

b. Remove the upper and lower carrying handles (2) and brace (if attached) from the front end of the case.

c. Remove external blower and front cover from case by pulling forward.

d. Remove the eight hex screws (Allen heads) (15) and lockwashers (16) securing the front plate to the case.

e. Slide case off from rear of chassis.

2-103. To replace the 490T-8 case proceed as follows:

a. Slide case onto chassis from rear; ensure that the air seals (items 157, 158, and 158A, figure 6-16) and gasket (37) are in place.

b. Secure the front plate and chassis to the case using the eight hex screws and lockwashers.

c. Slide the front panel cover and external blower on front end of chassis.

d. Replace the two carrying handles and tighten.

e. Connect the external blower to connector on front end of 490T-8.

2-104. OVERRALL PERFORMANCE TEST. Check the overall performance of the 490T-8 by performing the procedure outlined in table 2-28.

2-105. LOADING AND PHASING DISCRIMINATOR MODULE A2. The following paragraphs provide maintenance instructions for discriminator module A2.

2-106. Performance Tests. Check the performance standard of discriminator module A2 by performing the procedures outlined in table 2-29.

2-107. Removal/Replacement. The following paragraphs provide instruction for removal/replacement of discriminator module A2.

2-108. Remove discriminator module A2 as follows:

a. Remove 490T-8 from case according to paragraphs 2-101 and 2-102.

b. Loosen the two black captive screws that secure the discriminator (48) to the chassis.

c. Remove the discriminator from the chassis using the handle located on the discriminator case.

2-109. Replace discriminator module A2 as follows:

NOTE

Discriminator modules A2, Collins part numbers 768-5827-001 and 790-0779-001, are interchangeable. Part number 790-0779-001 has an arc-detector circuit added.

a. Insert the discriminator into the chassis, ensuring that the discriminator connector properly engages chassis connector.

b. Alternately tighten the two black captive screws to secure the discriminator to the chassis.

2-110. Adjustment. If discriminator module A2 fails to meet the requirements of the performance tests outlined in table 2-29 perform the following adjustment procedures.

a. Ensure that all power switches are off and connect the HP-606A signal generator through CU-2017 to PWR AMPL 1 IN jack on rf patch panel 1A3. Set HP-606A POWER switch to ON.

b. On rf patch panel set LOAD SELECT to OFF and PWR AMPL 1 METER SELECT to FWD PWR.

c. On AN/TSC-60(V) select transmitter no. 1 and perform normal turn-on procedures for system.

WARNING

Assure that transmitter is unkeyed before connecting or disconnecting the rf cable.

d. On transmitter control set XMT PWR to HIGH and allow at least 5 minutes warmup time.

e. Connect PWR AMPL 1 OUT jack on rf patch panel to J1 (first jack, left-hand side) on the 878L-37.

NOTE

Be sure the discriminator module is installed correctly on the 878L-37 to ensure proper grounding.

f. Install discriminator module on the 878L-37.

g. Set transmitter and HP-606A for 29.9999 MHz. Momentarily key transmitter and adjust HP-606A output level for enough drive to tune transmitter; allow up to 6 seconds for transmitter to tune.

h. Set CIRCUIT SELECTOR to INPUT PWR, momentarily key transmitter, and adjust HP-606A output level for an indication of 14 units (100 watts nominal) on test set METER.

i. Set CIRCUIT SELECTOR to PHASE, momentarily key transmitter, and (on the module) adjust PH ADJ R9 (figure 2-25) for a 0 indication on the test set METER.

j. Set CIRCUIT SELECTOR to INPUT PWR, momentarily key transmitter, and adjust HP-606A output level for an indication of 44 units (1000 watts nominal) on test set METER.

k. Set CIRCUIT SELECTOR to REFL PWR, momentarily key transmitter, and (on the module) adjust REFLECTED PWR ADJ C1 (figure 2-25) for a 0 indication on the test set METER.

l. Set CIRCUIT SELECTOR to INPUT PWR, momentarily key transmitter, and adjust HP-606A output level for an indication of 14 units (100 watts nominal) on test set METER.

m. Set CIRCUIT SELECTOR to LOAD, momentarily key transmitter, and (on the module) adjust LDG ADJ C4 (figure 2-25) for a 0 indication on test set METER.

n. Set transmitter and HP-606A to 14 MHz and repeat steps g. and l.

o. Set CIRCUIT SELECTOR to LOAD. Momentarily key transmitter, and note METER indication.

p. With transmitter keyed adjust LDG ADJ C4 until METER indication is one-half the reading in step o. (if other than 0).

q. Set transmitter and HP-606A for 29.9999 MHz and repeat steps g. and l.

r. Set CIRCUIT SELECTOR to LOAD, momentarily key transmitter, and adjust LDG ADJ C4 until the METER indicates the same at 29. 9999 MHz as at 14 MHz but opposite in polarity. Repeat steps m. through r. as necessary to obtain proper results.

Table 2-28. Performance Test Standards for Antenna Coupler CU-1896/TSC-60(V)1

TEST EQUIPMENT REQUIRED:

HF Signal Generator, HP-606A
Communication Central Training Set AN/TSC-60(V)1-T2
Electrical Dummy Load DA-652/TSC-60(V) (172H-8A Electrical Dummy Load)
Signal Generator Coupler CU-2017/TSC-60(V)

PRELIMINARY INSTRUCTIONS:

1. Ensure that all power switches are off and connect equipment as shown in figure 2-23.
2. Turn on HP-606A signal generator. Set frequency to 2.0000 MHz and adjust output level to zero.
3. On rf patch panel, set LOAD SELECT to OFF and PWR AMPL 1 METER SELECT to FWD PWR. On MONITOR/SWITCHING PANEL set COUPLER CONTROL SELECT RADIO NO 1 switch to the 1 position.
4. On AN/TSC-60(V), select transmitter no. 1 and perform the normal turn-on procedure for system.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
		TURN-ON		
1	a. On transmitter control set XMIT PWR to HIGH. b. Allow at least 5 minutes warmup time after initial turn-on. c. Set frequency selectors to 2.0000 MHz and momentarily press the INITIATE switch.			
		TUNING TEST		
2	a. Momentarily key system and slowly increase the rf output of HP-606A until system tunes.			Key lamp on transmitter control is on during tune cycle. (490T-8 holds system keyed.)

Table 2-28. Performance Test Standards for Antenna Coupler CU-1896/TSC-60(V)1 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	b. Tune-time; measure the time elapsed between time the power meter indicates 70 to 100 watts and the OPR lamp comes on.			Not more than 6 seconds.
	c. Key system and adjust output level of the HP-606A for an rf output of 1000 watts.			Rf output indicated on PWR AMPL 1 METER.
	d. With system keyed (1000-watt rf output) note any arcing within the 490T-8.			No arcing within the unit.
	e. Note rf output (1000 watts) for reference. Then set PWR AMPL METER SELECT to REFL PWR.			Reflected power not more than 1.7% of reference.
	f. Refer to figure 5-93 and determine the vswr.		NOTE If reflected power is below 10 watts, determine the vswr directly from the chart (figure 2-24). If the reflected power is above 10 watts, calculate vswr by using 1/2 reflected power and 1/2 forward power and determine the vswr directly from the chart. CAUTION Key system only when taking required meter readings.	Not more than 1.3:1.

Table 2-28. Performance Test Standards for Antenna Coupler CU-1896/TSC-60(V)1 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	g. Repeat steps a. through f. with the HP-606A and transmitter control set to the following frequencies: Freq in MHz 3.0000 12.0000 3.9999 15.9999 4.0000 16.0000 6.0000 23.0000 7.0000 29.9999 8.0000 h. Set all power switches to off and disconnect equipment.			Same as steps a. through f.

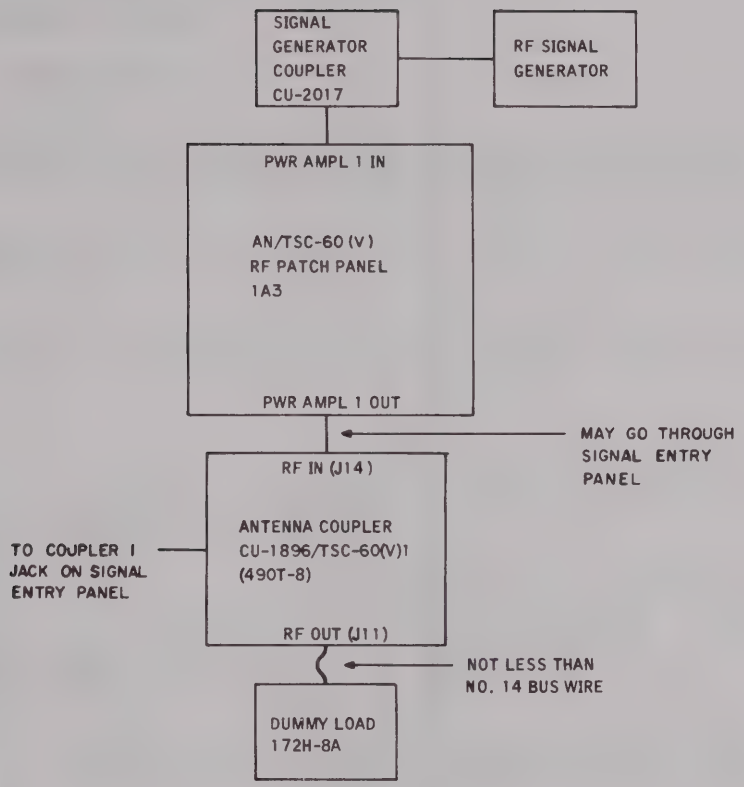

SIGNAL GENERATOR COUPLER CU-2017
RF SIGNAL GENERATOR
PWR AMPL 1 IN
AN/TSC-60 (V) RF PATCH PANEL 1A3
PWR AMPL 1 OUT
MAY GO THROUGH SIGNAL ENTRY PANEL
RF IN (J14)
ANTENNA COUPLER CU-1896/TSC-60(V)1 (490T-8)
TO COUPLER 1 JACK ON SIGNAL ENTRY PANEL
RF OUT (J11)
NOT LESS THAN NO. 14 BUS WIRE
DUMMY LOAD 172H-8A
B314 341 3

Figure 2-23. Antenna Coupler CU-1896/TSC-60(V)1 Test Setup

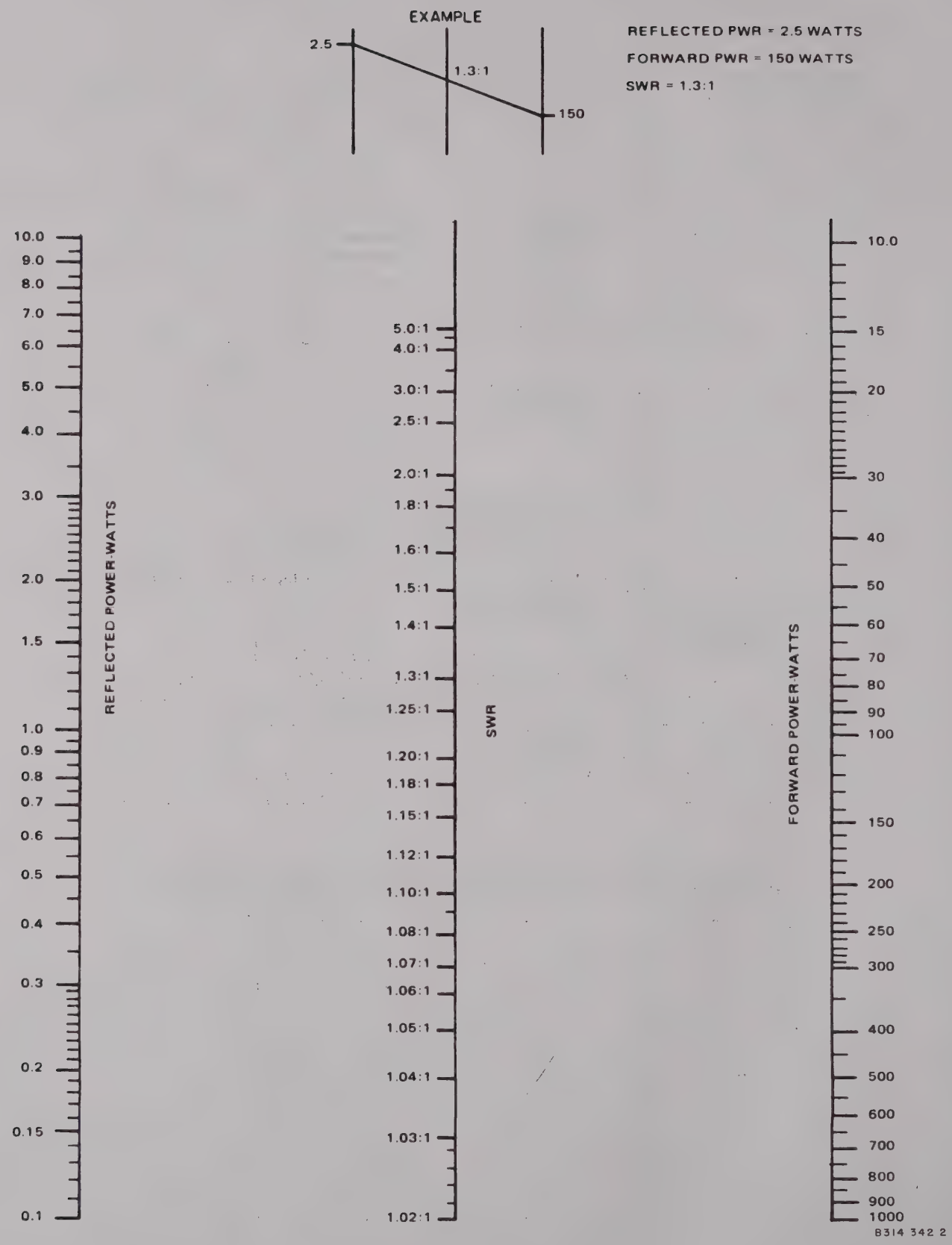


Figure 2-24. VSWR Chart

Table 2-29. Performance Test Standards for Discriminator Module A2

TEST EQUIPMENT REQUIRED:

Discriminator Simulator SM-686/T (878L-37 Discriminator Test Set)
HF Signal Generator, HP-606A
Signal Generator Coupler CU-2017/TSC-60(V)
Communication Central Training Set AN/TSC-60(V)1-T2
BNC to N Connector Adapter

PRELIMINARY INSTRUCTIONS:

1. Ensure that all power switches are off and connect the HP-606A signal generator through CU-2017/TSC-60(V) to PWR AMPL 1 IN jack on rf patch panel 1A3.

2. On rf patch panel set LOAD SELECT to OFF and PWR AMPL 1 METER SELECT to FWD PWR.

3. On AN/TSC-60(V) select transmitter no. 1 and perform normal turn-on procedures for system.

NOTE

Unless otherwise noted, reference to connectors, controls, and indicators apply to the 878L-37 test set.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	PRELIMINARY DISCRIMINATOR TEST SET CHECK			
1	a. Remove the 878L-37 test set from case and connect to a 115-Vac 60-Hz source; set POWER switch to ON. b. On transmitter control, set XMIT PWR to HIGH and allow at least 5 minutes warmup time. c. Set frequency selectors to 2.0000 MHz and momentarily press the INITIATE switch.		(1) Connect the PWR AMPL 1 OUT jack on rf path panel to J3 (third jack from left) on the 878L-37 using connector adapter.	Power lamp lights and blower operates on 878L-37.

Table 2-29. Performance Test Standards for Discriminator Module A2 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	d. Turn on the HP-606A and set frequency to 2.0000 MHz.			
	e. Set 878L-37 CIRCUIT SELECTOR to INPUT PWR, key transmitter and adjust the HP-606A output level until transmitter tunes. Then adjust output level for an indication of 14 units (100 watts nominal) on test set METER.			878L-37 METER indicates 14 units.
	DISCRIMINATOR TEST			
2	a. Unkey transmitter, disconnect rf cable from J3, and connect it to J1 on 878L-37.		WARNING Unkey transmitter before disconnecting rf cable from J3. NOTE Be sure the discriminator module is installed correctly on the 878L-37 to ensure proper grounding. (1) Install discriminator module to be tested on the 878L-37. NOTE Each time the transmiitter (PWR AMPL) and HP-606A are set to a new frequency, key the transmitter and adjust the HP-606A for enough drive to tune transmitter; allow up to 6 seconds for transmitter to tune, then unkey transmitter and continue tests.	

Table 2-29. Performance Test Standards for Discriminator Module A2 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	b. Momentarily key transmitter and observe METER on test set.			METER indicates 14 units. (If necessary adjust output level of the HP-606A.)
			NOTE Phase sensitivity (steps) c. through e.) is the algebraic difference between the meter reading obtained with the CIRCUIT SELECTOR set to the PHASE position and the meter reading obtained with the CIRCUIT SELECTOR set to the operating frequency.	
	c. Set the CIRCUIT SELECTOR to PHASE.		(2) With transmitter and HP-606A frequencies set to 2 MHz, momentarily key transmitter.	METER indicates -4 to +2 units. If indication is abnormal, perform adjustment procedures outlined in paragraph 2-110.
	d. Set CIRCUIT SELECTOR to 2 MHz.		(3) Momentarily key transmitter.	Note METER indication, and compute phase sensitivity. Phase sensitivity = 4 to 16 units difference.
	e. Repeat steps c. and d. at the following frequencies: 8, 14, and 29.9999 MHz.		(4) Periodically check rf input power level by setting CIRCUIT SELECTOR to INPUT PWR. Momentarily key transmitter and if necessary adjust the HP-606A output level to maintain an indication of 14 units on test set METER.	

Table 2-29. Performance Test Standards for Discriminator Module A2 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)			NOTE Load sensitivity (steps f. through i.) is the algebraic difference between the meter reading obtained with the CIRCUIT SELECTOR set to the LOAD position and the meter reading obtained with the CIRCUIT SELECTOR set to the LOAD SENS position.	
	f. Set CIRCUIT SELECTOR to INPUT PWR.		(5) Set transmitter and HP-606A frequencies to 2 MHz. Momentarily key transmitter and adjust HP-606A output level for an indication of 14 units (100 watts nominal) on test set METER.	
	g. Set CIRCUIT SELECTOR to LOAD.		(6) Momentarily key transmitter.	METER indicates -15 to +15 units. If indication is abnormal, perform adjustment procedures outlined in paragraph 2-110.
	h. Set CIRCUIT SELECTOR to LOAD SENS.		(7) Momentarily key transmitter.	Note METER indication, and compute load sensitivity. Load sensitivity = not less than 5 units difference.
	i. Repeat steps f. through h. at the following frequencies: 8, 14, and 29.9999 MHz.		(8) Periodically check rf input power level by setting CIRCUIT SELECTOR to INPUT PWR. Momentarily key transmitter and if necessary adjust the HP-606A output level to maintain an indication of 14 units on test set METER.	

Table 2-29. Performance Test Standards for Discriminator Module A2 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)			NOTE Reflected sensitivity (steps j. through m.) is the albegraic difference between the meter reading obtained with the CIRCUIT SELECTOR set to REFL PWR position and the meter reading obtained with the CIRCUIT SELECTOR set to REFL SENS position. CAUTION Duty cycle at 1-kW rf input is 5 minutes operating and 5 minutes off.	
	j. Set CIRCUIT SELECTOR to INPUT PWR.		(9) Set transmitter and HP-606A frequencies to 2 MHz, momentarily key transmitter, and adjust HP-6-6A output level for an indication of 44 units (1000 watts nominal) on test set METER.	
	k. Set CIRCUIT SELECTOR to REFL PWR.		(10) Momentarily key transmitter (at 1-kW rf output).	METER indicates -2 to +4 units. If indication is abnormal, perform adjustment procedure outlined in paragraph 2-110.
	l. Set the CIRCUIT SELECTOR to REFL SENS.		(11) Momentarily key transmitter (at 1-kW rf output).	Note METER indication. Compute reflected sensitivity. Reflected sensitivity = not less than 10 units.
	m. Repeat steps j. through l. at the following frequencies: 8, 14, and 29.9999 MHz.		(12) Periodically check rf input power level by setting CIRCUIT SELECTOR to INPUT PWR, and momentarily keying transmitter. If	

Table 2-29. Performance Test Standards for Discriminator Module A2 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)			necessary adjust the HP-606A output level to maintain an indication of 44 units on test set METER.	
	n. Set CIRCUIT SELECTOR to INPUT PWR.		(13) Set transmitter and HP-606A frequencies to 2 MHz and adjust HP-606A output level for an indication of 14 units (100 watts nominal) on test set METER.	
	o. Set CIRCUIT SELECTOR to FWD PWR.		(14) Momentarily key transmitter.	METER indicates 8 to 12 units.
	p. Leave CIRCUIT SELECTOR in FWD PWR.		(15) Repeat step o. at the following frequencies: 8, 14, and 29.9999 MHz. Periodically check rf input level by setting CIRCUIT SELECTOR to INPUT PWR, and momentarily keying transmitter. If necessary adjust the HP-606A output level to maintain an indication of 14 units on test set METER.	
	q. Set CIRCUIT SELECTOR to INPUT PWR.		(16) Set transmitter and HP-606A frequencies to 2 MHz, momentarily key transmitter, and adjust HP-606A output level for an indication of 44 units (1000 watts nominal) on test set METER.	
	r. Set CIRCUIT SELECTOR to FWD PWR.		(17) Momentarily key transmitter.	METER indicates 35 to 45 units.

Table 2-29. Performance Test Standards for Discriminator Module A2 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	s. Leave CIRCUIT SELECTOR in FWD PWR.		(18) Repeat step r. at the following frequencies: 8, 14, and 29.9999 MHz. Periodically check rf input level by setting CIRCUIT SELECTOR to INPUT PWR, and momentarily keying transmitter. If necessary adjust HP-606A output level to maintain an indication of 44 units on test set METER.	
	t. Set all POWER switches to OFF and disconnect equipment.		(19) Set POWER switch to OFF.	

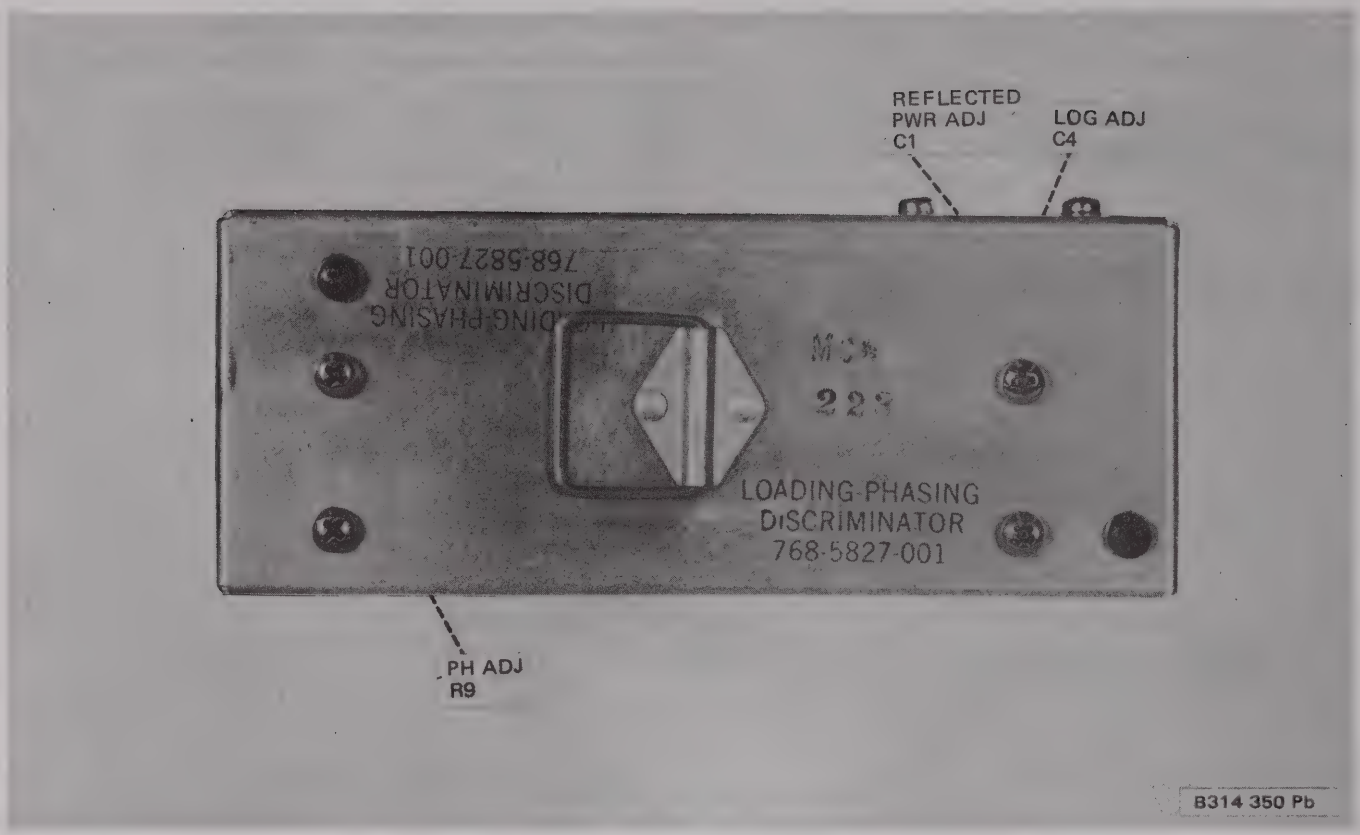


Figure 2-25. 490T-8 Discriminator Module A2, Adjustments Location

2-111. SERIES VARICOIL A3 AND SHUNT VARICOIL A4. The following paragraphs provide maintenance instructions for series varicoil A3 and shunt varicoil A4.

2-112. Performance Tests. Check the performance standard of A3 and A4 by performing the procedures outlined in table 2-30.

2-113. Removal/Replacement. The following paragraphs provide removal and replacement instructions for varicoils A3 and A4.

2-114. Remove series varicoil A3 as follows:

a. Remove 490T-8 case according to paragraphs 2-101 and 2-102.

b. Loosen terminal (72) from between the series varicoil and rf bypass switch by removing the screw (73) and lockwasher (74).

c. Remove screw (75) and lockwasher (76) securing electrical lead from relay to series varicoil.

d. Loosen the four captive screws securing the series varicoil to the chassis.

e. Remove the series varicoil by lifting away from the chassis.

2-115. Replace series varicoil A3 as follows:

CAUTION

Set AN/PSM-6 to RX1000 scale when checking resistance in the following procedures; excessive meter current can damage integrated circuits.

a. Insert the series varicoil into the chassis. Loosely insert captive screws (do not tighten). Be sure varicoil is inserted properly by checking for a ground on TB1-13 (48, figure 6-16) when varicoil is at maximum position or TB1-5 (48) when at minimum position.

b. Alternately tighten the four captive screws to secure the series varicoil to the chassis.

c. Secure electrical terminal to the series varicoil with lockwasher (76) and screw (75).

d. Secure terminal (72) to the series varicoil with lockwasher (74) and screw (73).

2-116. Remove shunt varicoil A4 as follows:

a. Remove 490T-8 case according to paragraphs 2-101 and 2-102.

b. Disconnect electrical lead (50) from relay to the shunt varicoil by removing screw (51) and lockwasher (52).

c. Loosen the four captive mounting screws that secure the shunt varicoil to the chassis.

d. Remove the shunt varicoil module from the chassis by pulling the module away from the chassis.

2-117. Replace shunt varicoil A4 as follows:

CAUTION

Set AN/PSM-6 to RX1000 scale when checking resistance in the following procedures; excessive meter current can damage integrated circuits.

a. Insert the shunt varicoil into the chassis. Loosely insert captive screws (do not tighten). Be sure varicoil is inserted properly by checking for a ground on TB1-9 (48) when varicoil is at maximum position or TB1-40 (48) when at minimum position.

b. Alternately tighten the four captive screws to secure the shunt varicoil to the chassis.

c. Secure electrical lead (50) from relay to shunt varicoil with lockwasher (52) and screw (51).

2-118. Adjustment. To replace and adjust the varicoil wiper assembly, figure 2-26, proceed as follows:

a. Adjust finger contacts on drive shaft for 6 ±2-gram pressure on electrical contact as measured with the 0- to 15-gram gauge.

b. Manually rotate varicoil drive shaft to its counterclockwise stop.

c. Assemble helical spring, contact insulator, and electrical contact to contact holder in the order shown in figure 2-26.

d. Engage electrical contact to top turn of coil.

e. Manually rotate varicoil drive shaft to clockwise stop.

f. By stretching or compressing the helical spring, adjust for contact pressure of 45 ±7 grams on rf coil as measured with the 10- to 100-gram gauge.

2-119. STEPPING COIL A5. The following paragraphs provide maintenance instructions for stepping coil A5 and removal/replacement instructions.

2-120. Performance Tests. Check the performance standard of stepping coil A5 by performing the procedure outlined in table 2-32.

2-121. Remove stepping coil A5 as follows:

a. Remove 490T-8 case according to paragraphs 2-101 and 2-102.

b. Remove series varicoil A3 according to paragraph 2-114.

c. Remove electrical lead (83) from shunt capacitor A6 to rf bypass switch by removing screw (84).

d. Remove three flathead screws (79) from the top; and four screws (80), four lockwashers (81), and four flat washers (82) from the left side securing the stepping coil to the chassis.

e. Remove one screw and washer just above screw (69).

f. Remove one screw and washer just left of and above shunt coil A4 (53).

g. Remove the stepping coil by pulling the stepping coil outward and on an angle from the chassis.

2-122. Replace stepping coil as follows:

CAUTION

Set AN/PSM-6 to RX1000 scale when checking resistance in the following procedure.

a. Insert the stepping coil assembly into the chassis. Be sure stepping coil is installed correctly and that the assembly connector engages the chassis connector by checking for ground at TB1-14 (48) when stepping coil is at maximum position or at TB1-15 (48) when stepping coil is at minimum position.

b. Secure the stepping coil assembly to the chassis with four screws (80) four lockwashers (91) and four flat washers (82) on the left side, and three screws on top.

c. Replace one screw and washer just above screw (69).

d. Replace one screw and washer just left of and above shunt varicoil A4 (53).

e. Replace series varicoil according to paragraph 2-115.

f. Replace electrical lead (83) from shunt capacitor A6 to rf bypass switch and tighten setscrew (71).

Table 2-30. Performance Test Standards for Series Varicoil A3 or Shunt Varicoil A4

TEST EQUIPMENT REQUIRED:

Capacitor-Coil Test Set TS-3360/T (878L-36A Coil-Capacitor Test Set)
Power Distribution Panel SB-3722/T (255B-1 Power Distribution Panel)
Stopwatch, Meylan 202A (or equivalent)

PRELIMINARY INSTRUCTIONS:

1. Using power cable provided, connect the 255B-1 to a 115-Vac 400-Hz source.

2. Using power cable provided, interconnect the 878L-36A with the 255B-1 (if in carrying case, this is already connected).

NOTE

Unless otherwise noted, reference to controls and indicators refers to the 878L-36A test set only. For test set fault lamp operation vs fault condition of the unit under test, refer to table 2-31.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Using 878L-36A test cable W1, interconnect the subassembly to be tested (A3 or A4) with the 878L-36A.			
2	Set TEST SELECT switch to position A3 or A4 as appropriate.			
3	Set POWER switches on the 255B-1 and the 878L-36A test set to the ON position.			
4	Set VOLTAGE ADJUST control for an indication of 80 units (35 Vac) on the test set meter.			

Table 2-30. Performance Test Standards for Series Varicoil A3 or Shunt Varicoil A4 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)			NOTE Steps 5 through 7 provide a self-test for the 878L-36A test set. The self-test capability of the 878L-36A provides a test of the monitoring and display circuits.	
5	Set FUNCTION switch to FAULT (first position).			FAULT lamps on and NORMAL lamp off.
6	Set FUNCTION switch to FAULT (second position).			FAULT lamps on and NORMAL lamp off.
7	Set FUNCTION switch to NORMAL.			NORMAL lamp on and FAULT lamps off.
			NOTE Step 8 applies to a new varicoil or one that has been out of service for an extended period of time.	
8	Alternately set the FUNCTION switch to position 1 (maximum) and position 2 (minimum) several times, allowing the varicoil arm to travel to the maximum and minimum limits each time. This will loosen up the mechanical parts of the varicoil.			Varicoil arm should reach both maximum and minimum limits while cycling.
9	Slowly rotate the FUNCTION switch through positions 1 through 5 (clockwise only) while observing the NORMAL and FAULT lamps.			NORMAL lamp on and FAULT lamps off in each position.

Table 2-30. Performance Test Standards for Series Varicoil A3 or Shunt Varicoil A4 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
10	Set FUNCTION switch to position 1 (maximum).			Varicoil arm should travel to the maximum limit.
11	Set FUNCTION switch to position 2 (minimum).			Varicoil arm should travel to the minimum limit.
12	With a stopwatch, measure the cycling time of the varicoil.			Cycle time not more than 1.2 seconds.
	FUNCTION Switch From / To / Function Position 1 / Position 2 / Maximum-to-minimum Position 2 / Position 1 / Minimum-to-maximum			
13	Set FUNCTION switch to position 3 (midturn).			Varicoil stops approximately four turns from minimum limit.
14	Set VOLTAGE ADJUST control for an indication of 20 units (7.0 Vac) on the test set meter.			
15	Alternately set the FUNCTION switch to positions 1 and 2, allowing 1 to 3 seconds for the varicoil to recycle each time.			Varicoil arm should travel from limit to limit without stopping.
16	Set all POWER switches to OFF and disconnect equipment.			

Table 2-31. 878L-36A Fault Lamps Vs Fault Conditions

NOTE

Place the 878L-36A test select switch in the appropriate position. Reference to connector pins applies to connector pins on unit under test.

FUNCTION SWITCH	FLT 1 (ON)				FLT 2 (ON)			
	A3/A4	A5	A6	A7	A3/A4	A5	A6	A7
1	(max) P1-R open	(max) P1-11 or P1-14 open	(max) P1-10 or P1-14 open	(min) P1-8 open	(max) P1-M or P1-P grounded	(max) P1-7 or P1-8 grounded	(max) P1-8 grounded or +28 Vdc missing from P1-9	(min) P1-6, P1-7, P1-13 or P1-14 grounded
2	(min) P1-P open	(min) P1-3 or P1-7 open	(min) P1-8 or P1-9 open	(max) P1-6 open	(min) P1-M or P1-R open	(min) P1-8, P1-11, or P1-14 grounded	(min) P1-14 grounded or +28 Vdc missing from P1-10	(max) P1-7, or P1-8, P1-13, P1-14 grounded
3	(1/2 turns) P1-M open	(6 turns) P1-11 open; check relay	No test	(100 pF) P1-13 open	(1/2 turns) P1-P or P1-R grounded	(6 turns) P1-7, P1-8, or P1-14 grounded	No test	(100 pF) P1-6, P1-7, P1-8 or P1-14 grounded
4	P1-F open	(9 turns) P1-8 or P1-11 open	No test	(50 pF) P1-7 open	No test	(9 turns) P1-7 or P1-14 grounded	No test	(50 pF) P1-6, P1-8, P1-13, or P1-14 grounded
5	No test	No test	No test	(25 pF) P1-14 open	No test	No test	No test	(25 pF) P1-6, P1-8, or P1-13 grounded

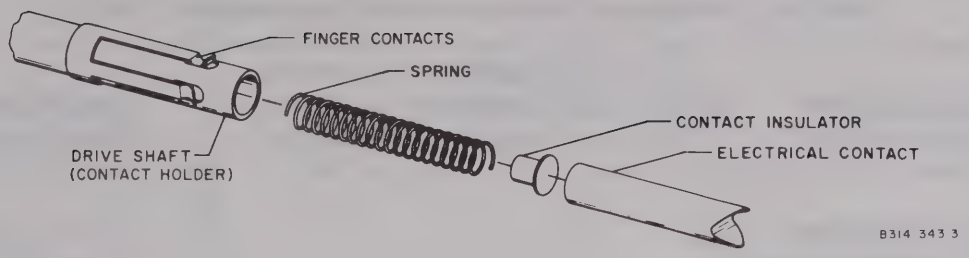


Figure 2-26. 490T-8 Varicoil Wiper Assembly

Table 2-32. Performance Test Standards for Stepping Coil A5

TEST EQUIPMENT REQUIRED:

Capacitor-Coil Test Set TS-3360/T (878L-36A Coil-Capacitor Test Set)
Power Distribution Panel SB-3722/T (255B-1 Power Distribution Panel)
Stopwatch, Maylan 202A (or equivalent)

PRELIMINARY INSTRUCTIONS:

1. Remove cover from stepping coil by removing the 15 flathead screws and slipping cover off end of coil.

2. Using power cable provided, connect the 255B-1 to a 115-Vac 400-Hz source.

3. Using power cable provided, connect the 878L-36A to the 255B-1 (if mounted in carrying case, this is already connected).

NOTE

Unless otherwise noted, reference to controls and indicators refer to the 878L-36A only. For test set fault lamp operation vs fault condition of unit under test, refer to table 2-31.

Table 2-32. Performance Test Standards for Stepping Coil A5 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Using 878L-36A test cable W2, interconnect stepping coil A5 with the 878L-36A.			
2	Set TEST SELECT switch to position A5.			
3	Set POWER switches on the 255B-1 and the 878L-36A test set to the ON position.			
4	Set VOLTAGE ADJUST control for an indication of 80 units (approximately 28 Vdc) on the test set meter.			
			NOTE Steps 5 through 7 provide a self-test for the 878L-36A test set. The self-test capability of the 878L-36A provides a test of the monitoring and display circuits.	
5	Set FUNCTION switch to FAULT (first position).			FAULT lamps on and NORMAL lamp off.
6	Set FUNCTION switch to FAULT (second position).			FAULT lamps on and NORMAL lamp off.
7	Set FUNCTION switch to NORMAL.			NORMAL lamp on and FAULT lamps off.
			NOTE Step 8 applies to a new stepping coil or one that has been out of service for an extended period of time.	

Table 2-32. Performance Test Standards for Stepping Coil A5 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
8	Alternately set the FUNCTION switch to position 1 (maximum) and position 2 (minimum) several times allowing the step coil to travel to the minimum and maximum limits each time. This will loosen up the mechanical parts of the stepping coil.			Stepping coil arm should reach both maximum and minimum limits while cycling.
9	Slowly rotate the FUNCTION switch through positions 1 through 5 (clockwise only) while observing the NORMAL and FAULT lamps.			NORMAL lamp on and FAULT lamps off in each position.
10	Set FUNCTION switch to position 1 (maximum). Note position of rf bypass switch.			Stepping coil arm should travel to the maximum limit. Rf bypass switch places the stepping coil in series with rf output circuit.
11	Set FUNCTION switch to position 2 (minimum). Note position of rf bypass switch.			Stepping coil arm should travel to five turns from the minimum limit. RF bypass switch should rotate 90°, bypassing the stepping coil and connecting the output of A3 directly to A6.
12	With a stopwatch, measure the cycling time of the stepping coil.			Cycle time: not more than 1.3 seconds.

FUNCTION Switch

From	To	Function
Position 1	Position 2	Maximum-to-minimum
Position 2	Position 1	Minimum-to-maximum

Table 2-32. Performance Test Standards for Stepping Coil A5 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
13	Set FUNCTION switch to position 3.			Stepping coil arm should stop at six turns from minimum limit and position of bypass switch is same as in position 1.
14	Set FUNCTION switch to position 4.			Stepping coil arm should stop at nine turns from minimum limit and bypass switch does not change.
15	Set VOLTAGE ADJUST control for an indication of 66 units (approximately 23 Vdc) on the test set meter.			
16	Alternately set the FUNCTION switch to positions 1 and 2, allowing up to 5 seconds for the stepping coil to recycle each time.			Stepping coil arm should travel without stopping from limit to limit.
17	Set all POWER switches to OFF and disconnect equipment.			
18	Replace cover on stepping coil A5 and secure with the 15 flathead screws.			

2-123. SHUNT CAPACITOR A6. The following paragraphs provide maintenance instructions for shunt capacitor A6.

2-124. Performance Tests. Check the performance standard of shunt capacitor A6 by performing the procedure outlined in table 2-33.

2-125. Removal/Replacement. The following paragraphs provide instruction for removal/replacement of shunt capacitor A6.

CAUTION

Observe type of screw threads and length to ensure reassembly without damage to equipment.

2-126. Remove shunt capacitor A6 as follows:

a. Remove 490T-8 case according to paragraphs 2-101 and 2-102.

b. Remove screw (62) and lockwasher (64) securing electrical lead (60) from series capacitor A13 to the shunt capacitor.

c. Remove electrical lead (83) from shunt capacitor to rf bypass switch by removing switch (84) and lockwasher (85), and loosening setscrew (71).

d. Remove five screws (87, 88, 89) securing shunt capacitor module to the chassis.

e. Remove the shunt capacitor module by lifting up and away from the chassis.

2-127. Replace shunt capacitor A6 as follows:

a. Insert the shunt capacitor into the chassis, ensuring that the assembly connector engages the chassis connector.

b. Secure the shunt capacitor to the chassis with five screws (87, 88, 89).

c. Insert electrical lead (83) into hole in rf bypass switch and tighten setscrew (71).

d. Secure electrical lead (83) from rf bypass switch to shunt capacitor with lockwasher (85) and screw (84).

e. Secure electrical lead (p/o 60) from the series capacitor to the shunt capacitor with lockwasher (64) and screw (62).

2-128. Adjustments. If shunt capacitor A6 fails to meet the requirements of table 2-33 , perform the following adjustments:

a. Remove the capacitor drive gear locking ring and disengage drive gear (figure 2-27).

b. Connect equipment as outlined in the preliminary instructions and step 1 of table 2-33.

c. Set TEST SELECT switch to A6 and FUNCTION switch to NORMAL.

d. Set the 255B-1 and 878L-36A test set POWER switches to ON.

e. Adjust the VOLTAGE ADJUST control for an 80-unit (28 Vdc) indication on the test set meter.

f. Set FUNCTION switch to position 1 (maximum) and observe wafer switch on the shunt capacitor (figure 2-27). Wafer switch should rotate cw and the motor should stop when the wafer switch reaches maximum position.

g. Set FUNCTION switch to position 2 (minimum) and observe wafer switch. Wafer switch should rotate ccw and the motor should stop when the wafer switch reaches minimum position.

CAUTION

When adjusting the stop collar, do not force stop collar against the capacitor collar.

h. Engage the capacitor drive gear with the spline of the lead screw; do not engage with the cluster gear (figure 2-27). Rotate lead screw ccw until the stop collar rests against the capacitor collar. Rotate lead screw cw until there is 0.005 ±0.004-inch clearance between the stop collar and the capacitor collar. This spacing may be set using a 0.005-inch shim.

i. Take care not to move the wafer switch off maximum position and engage the capacitor drive gear with the cluster gear. Reinstall the capacitor drive gear locking ring.

j. Perform the performance test procedures outlined in table 2-33.

2-129. SERIES CAPACITOR DRIVE ASSEMBLY A7. The following paragraphs provide maintenance instructions for drive assembly A7.

2-130. Performance Tests. Check the performance standard of drive assembly A7 by performing the procedures outlined in table 2-34.

2-131. Removal/Replacement. The following paragraphs provide removal/replacement instructions for drive assembly A7.

2-132. Remove drive assembly A7 as follows:

CAUTION

Observe type of screws, threads, and length, to ensure reassembly without damage to the equipment.

a. Remove 490T-8 case according to paragraphs 2-101 and 2-102.

b. Remove series capacitor A13 according to paragraph 2-137.

c. Remove shunt capacitor A6 according to paragraph 2-126.

d. Remove series varicoil A3 according to paragraph 2-114.

e. Remove two screws and washers that secure the capacitor located directly in back of the drive assembly and two screws holding capacitor mounting bracket.

f. Remove four screws (69), four lockwashers (70), and one screw (located on side) securing the drive assembly to the chassis.

g. Remove one screw just below and to the right of shunt varicoil A4 (53).

h. Remove the series capacitor drive assembly by pulling slightly toward rear of chassis to disconnect the connector; then pull assembly outward from the chassis.

2-133. Replace drive assembly A7 as follows:

a. Insert the series capacitor drive assembly into the chassis, ensuring that the assembly connector engages the chassis connector.

b. Secure the series capacitor drive assembly to the chassis with four lockwashers (70), four screws (69), and one screw (located on side).

c. Replace capacitor in chassis and two screws and washers and replace capacitor bracket with two screws and washers.

d. Replace series varicoil A3 according to paragraph 2-115.

e. Replace shunt capacitor A6 according to paragraph 2-127.

f. Replace series capacitor A13 according to paragraph 2-138.

Table 2-33. Performance Test Standards for Shunt Capacitor A6

TEST EQUIPMENT REQUIRED:

Capacitor-Coil Test Set TS-3360/T (878L-36A Coil-Capacitor Test Set)
Power Distribution Panel SB-3722/T (255B-1 Power Distribution Panel)
Q-Meter, Boonton 260A
Capacitor, 100-pF (2 required)
Stopwatch, Meylan 202A (or equivalent)

PRELIMINARY INSTRUCTIONS:

1. Using power cable provided, connect the 255B-1 to a 115-Vac 400-Hz source.

2. Using power cable provided, connect the 878L-36A to the 255B-1 (if mounted in carrying case, this is already connected).

NOTE

Unless otherwise noted reference to controls and indicators refer to the 878L-36A test set only. For test set fault lamp operation vs fault condition of unit under test, refer to table 2-31.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Using 878L-36A test cable W2, interconnect shunt capacitor A6 with the 878L-36A.			
2	Set TEST SELECT switch to position A6.			
3	Set POWER switches on the 255B-1 and the 878L-36A test set to the ON position.			
4	Set VOLTAGE ADJUST control for an indication of 80 units (approximately 28 Vdc) on the test set meter.			

Table 2-33. Performance Test Standards for Shunt Capacitor A6 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
			NOTE Steps 5 through 7 provide a self-test for the 878L-36A test set. The self-test capability of the 878L-36A provides a test of the monitoring and display circuits.	
5	Set FUNCTION switch to FAULT (first position).			FAULT lamps on and NORMAL lamp off.
6	Set FUNCTION switch to FAULT (second position).			FAULT lamps on and NORMAL lamp off.
7	Set FUNCTION switch to NORMAL.			NOTE Shunt capacitor A6 is closed at maximum capacitance and open at minimum capacitance.
			NOTE Step 8 applies to a new shunt capacitor or one that has been out of service for an extended period of time.	
8	Cycle the shunt capacitor from limit to limit approximately 10 times by setting the FUNCTION switch to position 1 (maximum) and position 2 (minimum). Allow capacitor to complete cycle each time.			Capacitor travels from maximum to minimum limit each cycle.
9	Slowly rotate the FUNCTION switch from positions 1 through 5 (clockwise only) while observing the NORMAL and FAULT lamps.			NORMAL lamp on and FAULT lamps off for each position.

Table 2-33. Performance Test Standards for Shunt Capacitor A6 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	NOTE The shunt capacitor tuning drive limit switches should be activated when shunt capacitor is at 5 to 7 pF (minimum) and 450 to 500 pF (maximum). However, the Boonton 260A Q-Meter range is from 30 to 460 pF. The range of the 260A may be extended as follows: Measure the internal capacitance of the 260A with a 500-kHz coil installed. Measure the exact capacity of a nominal 100-pF capacitor (Cn) on the 260A. Maximum capacitance (C max): Calculate the maximum capacity of the shunt capacitor using the following formula: $Cv\ (max) = \frac{\text{Exact value of Cn x Ct}}{\text{Exact value of Cn - Ct}}$ Cn = Nominal 100-pF capacitor Ct = Total capacity of the shunt capacitor Cv (max) = Maximum capacity of the shunt capacitor Minimum capacitance (C min): Calculate the minimum capacity of the shunt capacitor using the following formula: Ct - Exact value of Cn = Cv (min) = Minimum capacity of the shunt capacitor			
10	Set FUNCTION switch to position 1 (maximum). Observe wafer switch and capacitor plates (figure 2-27). Note that the gimbal collar does not bottom on the capacitor collar.			Wafer switch should rotate ccw to maximum position. Capacitor plates should be in closed position.
11	Connect the 100-pF capacitor (Cn) in series with the shunt capacitor, then connect this combination to the 260A (figure 2-27).			
12	Set the 260A to measure capacitance at 500 kHz.			

Table 2-33. Performance Test Standards for Shunt Capacitor A6 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
13	Measure the maximum capacity of the shunt capacitor on the 260A.			Computed total 450 to 500 pF. If required, adjust maximum capacitance by removing the shunt capacitor drive gear locking ring and disengaging the drive gear from the cluster gear (figure 2-27). Manually adjust capacitor for 475 pF measured on the 260A. After satisfactory adjustment, reengage drive gear with cluster gear and reinstall locking ring. (Ensure that the wafer switch does not move off maximum position.)
14	Set FUNCTION switch to position 2 (minimum). Observe the wafer switch and capacitor plates.			Wafer switch should rotate cw to the minimum position. Capacitor plates should be in open position.
15	Connect the 100-pF (Cn) in parallel with the shunt capacitor, then connect this combination to the 260A (figure 2-27).			
16	Set the 260A to measure capacitance at 300, 400, or 500 kHz.			
17	Measure the minimum capacity of the shunt capacitor on the 260A.			Computed difference 5 to 7 pF. If required, adjust minimum capacitance by removing the shunt capacitor drive gear locking ring and disengaging the drive gear from the cluster gear.

Table 2-33. Performance Test Standards for Shunt Capacitor A6 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
17 (Cont)				Manually adjust capacitor for 6 pF measured on the 260A. After satisfactory adjustment, reengage drive gear with cluster gear and reinstall locking ring. (Ensure that the wafer switch does not move off minimum position.)
18	Using a stopwatch, measure the tune time (maximum limit to minimum limit) by setting the FUNCTION switch to position 1 (maximum), then position 2 (minimum).			Not more than 1.4 seconds.
19	Using a stopwatch, measure the home time (minimum limit to maximum limit) by setting the FUNCTION switch to position 2 (minimum), then position 1 (maximum).			Not more than 1.2 seconds.
20	Set the VOLTAGE ADJUST control for an indication of 66 units (approximately 23 Vdc) on the test set meter.			
21	Repeat step 18.			Not more than 1.8 seconds.
22	Repeat step 19.			Not more than 5 seconds.
23	Set all POWER switches to OFF and disconnect equipment.			

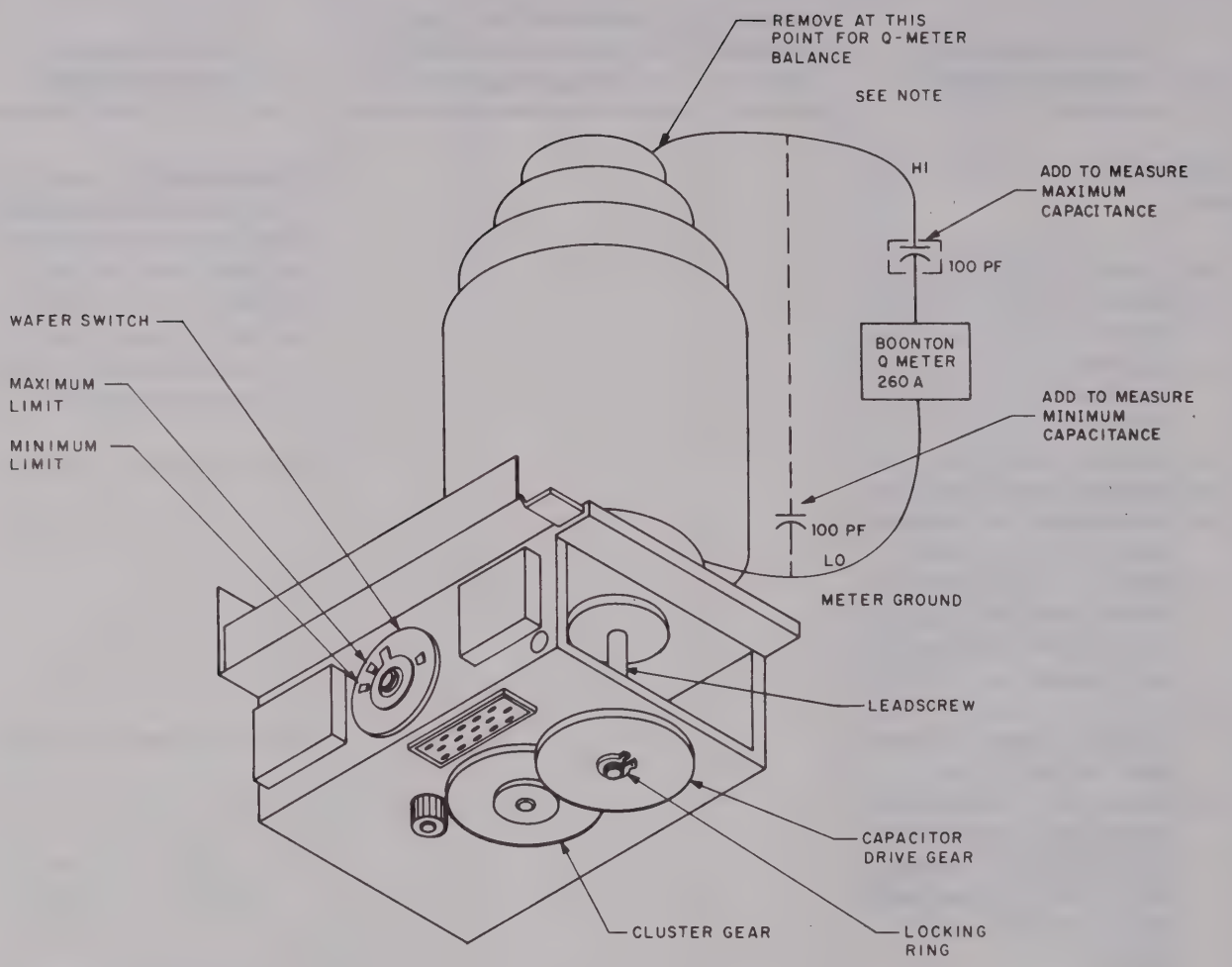


Figure 2-27. 490T-8 Shunt Capacitor A6 Test Point and Adjustment Location

Table 2-34. Performance Test Standards for Series Capacitor Drive Assembly A7

TEST EQUIPMENT REQUIRED:

Capacitor-Coil Test Set TS-3360/T (878L-36A Coil-Capacitor Test Set)
Power Distribution Panel SB-3722/T (255B-1 Power Distribution Panel)
Stopwatch, Maylan 202A (or equivalent)

PRELIMINARY INSTRUCTIONS:

1. Using power cable provided, connect the 255B-1 to 115-Vac 400-Hz source.

2. Using power cable provided, connect the 878L-36A to the 255B-1 (if mounted in carrying case, this is already connected).

NOTE

Unless otherwise noted, reference to controls and indicators refer to the 878L-36A test set only. For test set fault lamp operation vs fault condition of unit under test, refer to table 2-31.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Using 878L-36A test cable W2, interconnect the drive assy A7 with the 878L-36A test set.			
2	Set TEST SELECT switch to position A7.			
3	Set POWER switches on the 255B-1 and the 878L-36A test set to the ON position.			
4	Set VOLTAGE ADJUST control for an indication of 80 units (approximately 28 Vdc) on the test set meter.			
			NOTE Steps 5 through 7 provide a self-test for the 878L-36A test set. The self-test capability of the 878L-36A provides a test of the monitoring and display circuits.	

Table 2-34. Performance Test Standards for Series Capacitor Drive Assembly A7 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5	Set FUNCTION switch to FAULT (first position).			FAULT lamps on and NORMAL lamp off.
6	Set FUNCTION switch to FAULT (second position).			FAULT lamps on and NORMAL lamp off.
7	Set FUNCTION switch to NORMAL.			NORMAL lamp on and FAULT lamps off.
			NOTE Step 8 applies to a new drive assembly or one that has been out of service for an extended period of time.	
8	Cycle the drive assembly from minimum to maximum approximately 10 times by alternately setting the FUNCTION switch to position 1 (minimum) and position 2 (maximum). Allow time for the driver assembly to complete each cycle.			
9	Slowly rotate the FUNCTION switch from positions 1 through 5 (clockwise only) and observe the NORMAL and FAULT lamps.			NORMAL lamp on and FAULT lamps off.
10	With a stopwatch, measure the cycling time of the drive assembly. FUNCTION Switch From / To / Function Position 1 / Position 2 / Minimum to maximum Position 2 / Position 1 / Maximum to minimum			Cycle time not more than 1.2 seconds.

Table 2-34. Performance Test Standards for Series Capacitor Drive Assembly A7 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
11	Set VOLTAGE ADJUST control for an indication of 66 units (approximately 23 Vdc) on the test set meter.			
12	Set FUNCTION switch from position 1 (minimum) to position 2 (maximum) then from position 2 (maximum) to position 1 (minimum).			Drive assembly runs from limit to limit without stopping. After completion of step 12, run drive assembly to maximum position for installation in 490T-8.
13	Set all POWER switches to OFF and disconnect equipment.			

2-134. SUBASSEMBLIES A3, A4, A5, A6, A7, A12, AND A13 INSTALLED IN THE 490T-8 CHASSIS. The following paragraphs provide instructions for checking the above subassemblies installed in the 490T-3 chassis.

NOTE

Series capacitor A13 is tested in conjunction with subassemblies A3, A4, A5, A6, A7 and A12 installed in a 490T-8 chassis. Subassembly A6 must be good before subassembly A5 or A7 will check good.

2-135. Performance Tests. Table 2-35 outlines the procedure for checking the performance standards of A3, A4, A5, A6, A7 and A12 installed in the 490T-8 chassis.

2-136. Removal/Replacement, Series Capacitor A13. The following paragraphs provide instructions for removal/replacement of Series Capacitor A13.

2-137. Remove series capacitor A13 as follows:

a. Remove 490T-8 case according to paragraphs 2-101 and 2-102.

b. Remove the four flathead screws (59) that secure ring (58) to the chassis.

c. Remove the two screws and two washers securing insulator and spacer to the series capacitor.

d. Remove electrical receptacle and electrical lead (55) by removing two screws (56) and two lockwashers (57).

e. Remove insulator and spacer by pulling away from the series capacitor.

f. Remove screw and lockwasher securing electrical lead (54) from relay to the series capacitor. Access hole to screw is located in rear capacitor mount.

g. Remove screw (62) and lockwasher (64) securing electrical lead (P060) from the series capacitor to shunt capacitor A6.

h. Remove rear capacitor mount by supporting the series capacitor and removing two screws (61) and two flat washers (63) that secure the rear capacitor mount to the chassis.

i. Support the series capacitor and remove the two screws and two flat washers that secure the front capacitor mount to the chassis. Carefully pull the series capacitor assembly toward the rear to disengage the coupling insulator (67).

2-138. Replace series capacitor A13 as follows:

NOTE

Before replacing the series capacitor, the rear mount must be removed.

a. Replace two washers (65) and sleeve (66) on the series capacitor drive shaft.

b. Carefully insert coupling insulator (67) into the sleeve (66).

c. Support the series capacitor and carefully insert the free end of the coupling insulator (67) into the series capacitor drive assembly A7.

d. Support the series capacitor and secure the front mount to the chassis with two flat washers and two screws. Do not tighten at this time.

NOTE

After the series capacitor has been connected to the drive assembly, the capacitor must be aligned to ensure synchronization of the control logic with the mechanical position of the series capacitor plates.

e. Perform alignment procedures in paragraph 2-133.

f. Secure electrical lead (44) from relay to the series capacitor with lockwasher and screw.

g. Secure electrical lead (55) to electrical receptacle with two lockwashers (57) and two screws (56).

h. Secure spacer and insulator to the series capacitor with two lockwashers and two screws.

i. Support the series capacitor and secure rear capacitor mount to the chassis with two flat washers (63) and two screws (61). Do not tighten screws at this time.

j. Secure ring (58) to the chassis with four flathead screws (59).

k. Secure electrical lead (p/o 60) from the series capacitor to the shunt capacitor with lockwasher (64) and screw (62).

2-139. Adjustment. After series capacitor A13 has been installed, the following alignment procedures must be completed to ensure synchronization of the control logic with the mechanical position of the series capacitor plates.

a. Perform the preliminary instructions outlined in table 2-35.

b. Set TEST SELECT switch to A7 and FUNCTION switch to NORMAL.

c. Set the 255B-1 and 878L-36A POWER switches to ON.

d. Remove two screws that fasten the cover to the series capacitor drive assembly A7.

e. Disengage the capacitor tuning drive gears by pulling the coupling shaft toward the rear of the chassis. The gear and shaft combination will come out of the bearing in the capacitor tuning drive housing.

f. Home the series capacitor drive assembly by setting the FUNCTION switch to position 2 (maximum). Set the 878L-36A POWER switch to OFF.

g. With the leads of an AN/PSM-6 connected across the plates of series capacitor A13, manually rotate the coupling shaft clockwise (viewed from rear to front of the chassis) until the capacitor plates are shorted (AN/PSM-6 indicates zero resistance).

h. Engage the series capacitor tuning drive gears.

i. Connect AN/PSM-6 between ground and pin 85 on the planar interconnect board (TB1). The AN/PSM-6 should indicate zero resistance.

NOTE

Pin 85 is silk-screened on the interconnect board (TB1) and may be reached with test cable W3 connected, or momentarily disconnect cable W3 to connect the AN/PSM-6.

j. Ensure the series capacitor drive gears are still engaged, then manually rotate the series capacitor coupling shaft counterclockwise (viewed from rear to front on the chassis) until the AN/PSM-6 indicates an open.

NOTE

This setting is critical; therefore, adjustment of the series capacitor must stop at the first indication of an open.

k. Again disengage the capacitor tuning drive gears; however, ensure that the placement of the small gear is not disturbed.

l. Connect the AN/PSM-6 leads between the series capacitor plates, and rotate the coupling shaft clockwise (viewed from rear to front of chassis) until the series capacitor plates are again shorted (AN/PSM-6 indicates zero resistance).

m. Rotate the coupling shaft counterclockwise (viewed from rear to front of chassis) until the AN/PSM-6 indicates the series capacitor plates are not shorted (AN/PSM-6 indicates an open circuit).

NOTE

Adjustment of the capacitor must stop at the first indication that the plates are not shorted.

n. Engage the capacitor tuning drive gears.

o. Set the 878L-36A POWER switch to ON.

p. Set FUNCTION switch to position 1 (minimum), then to position 2 (maximum). The equipment should home and the AN/PSM-6 should indicate the capacitor plates are shorted (zero resistance).

q. If the series capacitor plates did not short in step p., set the 878L-36A POWER switch to OFF, disengage the tuning drive gear, and advance the large gear one tooth clockwise. Repeat steps n., o., and p.

r. To ensure synchronization, rotate the capacitor tuning drive gear counterclockwise (viewed from rear to front of chassis) until the AN/PSM-6 indicates an open circuit. Repeat step p. If necessary, repeat steps q. and r.

s. Replace series capacitor drive assembly A7 cover and fasten with two screws.

t. Perform steps f. through k. of paragraph 2-138 to complete installation of A13.

u. Perform procedures outlined in table 2-35.

Table 2-35. Performance Test Standards for A3, A4, A5, A6, A7, A12, and A13 Installed in a 490T-8 Chassis

TEST EQUIPMENT REQUIRED:

Capacitor-Coil Test Set TS-3360/T (878L-36A Capacitor-Coil Test Set)
Power Distribution Panel SB-3722/T (255B-1 Power Distribution Panel)
Stopwatch, Meylan 202A (or equivalent)
Multimeter, AN/PSM-6

PRELIMINARY INSTRUCTIONS:

1. Ensure that the power switches on the test equipment are in OFF position.

2. Remove the 490T-8 from case, refer to paragraphs 2-101 and 2-102.

3. Remove 490T-8 electronic control amplifier card A8 (paragraph 2-143) and connect 878L-36A test cable W3-P3 in its place (on the planar interconnect board on the chassis).

CAUTION

Care must be taken when removing or replacing circuit boards or connectors on the planar interconnect board (TB1) so as not to damage the long connector pins on the planar interconnect board.

4. Remove the 7 screws securing the three control cards to the planar interconnect board on the chassis.

5. Remove control cards no. 1 (A9), no. 2 (A10), and URG control card (A11) from the planar interconnect board and connect 878L-36A test cable W3-P1 to J1 on the 878L-36A.

6. Connect 878L-36A test cable W3-P1 to J1 on the 878L-36A.

7. Using the ac power cable provided, connect the 255B-1 to a 115-Vac 400-Hz source.

8. Using the ac power cable provided, connect the 878L-36A to the 255B-1 (if mounted in carrying case this is already connected).

NOTE

Unless otherwise noted, reference to controls or indicators refer to the 878L-36A only. For test set fault lamp operation vs fault condition of the unit under test, refer to table 2-31.

Table 2-35. Performance Test Standards for A3, A4, A5, A6, A7, A12, and A13 Installed in a 490T-8 Chassis (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	Set TEST SELECT switch to A3. Set the 878L-36A FUNCTION switch to the first FAULT position.			
2	Set POWER switches on the 255B-1 and the 878L-36A to ON.			
3	Set VOLTAGE ADJUST control for an indication of 80 units on test set meter.		NOTE Steps 4 through 6 provide a self-test for the 878L-36A test set. The self-test capability of the 878L-36A provides a test of the monitoring and display circuits.	
4	Set FUNCTION switch to FAULT (first position).			FAULT lamps on and NORMAL lamp off.
5	Set FUNCTION switch to FAULT (second position)			FAULT lamps on and NORMAL lamp off.
6	Set FUNCTION switch to NORMAL.			NORMAL lamp on and FAULT lamps off.
7	Perform procedures outlined in table 2-30, steps 9 through 15.			Same as in table 2-30.
8	Set TEST SELECT switch to A4. Set VOLTAGE ADJUST control for an indication of 80 units (35 Vac) on the test set meter, and repeat step 7.			Same as in table 2-30.

Table 2-35. Performance Test Standards for A3, A4, A5, A6, A7, A12, and A13 Installed in a 490T-8 Chassis (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
9	Set TEST SELECT switch to A5 and reset VOLTAGE ADJUST control for an indication of 80 units on test set meter.			
10	Perform procedures outlines in table 2-32, steps 9 through 16.			Same as table 2-32.
11	Set TEST SELECT switch to A6 and reset VOLTAGE ADJUST control for an indication of 80 units on test set meter.			
12	Perform procedures outlined in table 2-33, steps 9 and 18 through 22.			Same as table 2-33.
13	Set TEST SELECT switch to A7 and reset VOLTAGE ADJUST control for an indication of 80 units on test set meter.			
14	Perform procedures outlined in table 2-34, steps 9 through 12.			Same as table 2-34.
15	Reset VOLTAGE ADJUST control for an indication of 80 units on test set meter.			
16	Set FUNCTION switch to position 1 (with TEST SELECT switch in position A7).			Series capacitor A13 should run to minimum capacitance position. NORMAL lamp on and FAULT lamps off.

Table 2-35. Performance Test Standards for A3, A4, A5, A6, A7, A12, and A13 Installed in a 490T-8 Chassis (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
17	Set FUNCTION switch to position 2.			Series capacitor A13 should run to home position (capacitor plates shorted together). NORMAL lamp on, FAULT lamps out.
18	Using an AN/PSM-6, check dc resistance between the plates of series capacitor A13.			The AN/PSM-6 should indicate a direct dc short.
19	Slowly rotate the FUNCTION switch through positions 3 through 5.			NORMAL lamp on, FAULT lamps out in each position.
20	Set all POWER switches to the OFF position, disconnect test equipment, remove and/or replace subassemblies as required.		NOTE If no failure occurs during the preceding subassemblies checks, power supply module A12 is functionally good.	

2-140. ELECTRONIC CONTROL AMPLIFIER A8. The following paragraphs provide maintenance instructions for electronic control amplifier A8.

2-141. Performance Tests. Check the performance standard of A8 by performing the procedures outlined in table 2-36.

2-142. Removal/Replacement. The following paragraphs provide removal/replacement instructions for electronic control amplifier A8.

2-143. Remove electronic control amplifier A8 as follows:

a. Remove 490T-8 case according to paragraphs 2-101 and 2-102.

b. Remove control amplifier retaining strap.

c. Remove by pulling control amplifier card outward from the 490T-8 chassis.

2-144. Replace electronic control amplifier A8 as follows:

a. Inspect the connector pins on the planar interconnect board to ensure that none are bent.

b. Insert the control amplifier card into the chassis, ensuring that the connector on the card engages the pins on the planar interconnect board.

c. Replace the control amplifier retaining strap.

2-145. POWER SUPPLY MODULE A12. The following paragraphs provide maintenance instructions for power supply module A12.

2-146. Performance Tests. Check the performance standard of A12 by performing the procedures outlined in table 2-38.

2-147. Removal/Replacement. The following paragraphs provide removal/replacement instructions for power supply module A12.

2-148. Remove power supply module A12 as follows:

a. Remove 490T-8 case according to paragraphs 2-101 and 2-102.

b. Remove the eight flathead screws (144, figure 6-16) that secure the end plate to the front end of chassis and pull plate forward and to the side to gain access to the power supply.

c. Remove two screws (46, figure 6-1) and two screws (47) that secure the power supply to the chassis.

d. Being careful of the end plate, pull power supply free of chassis.

2-149. Replace power supply module A12 as follows:

a. Replace the power supply into the chassis; make sure the connector is properly connected.

b. Secure power supply to chassis with the two screws (46) and the two screws (47).

c. Replace the end plate and secure the eight flathead screws (144, figure 6-16).

2-150. Adjustments. If power supply module A12 fails to meet the requirements in table 2-38 perform the following adjustments:

a. Perform the procedures outlined in preliminary instructions and steps 1 and 2 of table 2-38.

WARNING

Use caution when working on the power supply module; high voltage is exposed at several points.

b. Remove the protective plastic cover from power supply and connect the high side of the 8300A digital voltmeter to the collector of Q1 on the power supply and the low side to the junction of R13 and R14 (E18). See figure 2-29.

NOTE

Set meter range to 1000 Vdc.

c. Set POWER switches on the 255B-1 and the 878L-33A to ON and set EXT BLO switch on power supply holder to on.

d. Adjust R53 on power supply for +290 ±5 Vdc. See figure 2-29.

e. Adjust R21 on power supply for 396 Hz indicated on the HP-5245L frequency counter. See figure 2-29.

f. Set EXT BLO and POWER switch to OFF and disconnect the 8300A from the power supply.

g. Connect the 8300A to the +5 VDC jack on power supply holder and set POWER switches to ON.

h. Adjust R45 to +5 Vdc indicated on the 8300A.

i. Perform the procedures outlined in table 2-38.

NOTE

To aid in troubleshooting, the power supply module may be partly disassembled and mounted on the power supply holder. (1) Remove three screws holding the small circuit card on the bottom of module and pull circuit card to the right and mount in in the slot provided on the power supply holder; (2) Remove five screws holding the top assembly of the power supply and turn assembly upside down and place on the top left-hand side of power supply holder. Secure the power supply to the power supply holder and install the protective plastic covers provided.

Table 2-36. Performance Test Standards for Electronic Control Amplifier A8

TEST EQUIPMENT REQUIRED:

Amplifier Test Set TS-3359/T (878L-35 Amplifier Test Set)
Power Distribution Panel SB-3722/T (255B-1 Power Distribution Panel)
Stopwatch, Meylan 202A (or equivalent)

PRELIMINARY INSTRUCTIONS:

1. Using the ac power cable provided, connect the 255B-1 to 115-Vac 400-Hz source.
2. Using the ac power cable provided, connect the 878L-35 to the 255B-1 (if mounted in carrying case this is already connected).
3. Using 878L-35 test cable W1, connect the card holder to J1 on the 878L-35.

NOTE

Unless otherwise noted, reference to controls and indicators refer to the 878L-35 test set only. For test set fault lamps operation and meter readings vs fault condition of the unit under test, refer to table 2-37.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
			SERIES SERVO PERFORMANCE TEST	
1	Install the electronic control amplifier A8 on the card holder.			
2	Set POWER switches on the 255B-1 and the 878L-35 to the ON position.		NOTE Steps 3 and 4 provide a self-test for the 878L-35 test set. The self-test capability of the 878L-35 provides a test of the monitoring display circuits.	

Table 2-36. Performance Test Standards for Electronic Control Amplifier A8 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2	Set POWER switches on the 255B-1 and the 878L-35 to the ON position.		NOTE Steps 3 and 4 provide a self-test for the 878L-35 test set. The self-test capability of the 878L-35 provides a test of the monitoring and display circuits.	
3	Set FUNCTION switch to FAULT position and observe the NORMAL and FAULT lamps.			FAULT lamps on and NORMAL lamp off.
4	Set FUNCTION switch to NORMAL position and observe the NORMAL and FAULT lamps.			NORMAL lamp on and FAULT lamps off.
5	Set SERVO TEST switch to the SERIES position and set the INPUT control to the center position. NOTE When the FUNCTION switch is set to a new position, wait for the READY lamp to come on before pushing the TEST INITIATE switch. It may take as long as 15 seconds for the READY light to come on.			

Table 2-36. Performance Test Standards for Electronic Control Amplifier A8 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6	Set FUNCTION switch to position 1 and momentarily push the TEST INITIATE switch.			Not less than 50 units on meter. NORMAL lamp on and FAULT lamps off.
7	Set FUNCTION switch to position 2 and momentarily push the TEST INITIATE switch.			72 to 88 units on meter. NORMAL lamp on and FAULT lamps off.
8	Set FUNCTION switch to position 3 and momentarily push the TEST INITIATE switch.			72 to 88 units on meter. NORMAL lamp on and FAULT lamps off.
9	Set FUNCTION switch to position 4 and momentarily push the TEST INITIATE switch.			6 to 41 units on meter. NORMAL lamp on and FAULT lamps off.
10	Set FUNCTION switch to position 5 and momentarily push the TEST INITIATE switch.			18 to 89 units on meter. NORMAL lamp on and FAULT lamps off.
11	Set FUNCTION switch to position 6 and momentarily push the TEST INITIATE switch. NOTE Steps 12 and 13 must be completed before the test set timing circuit times out, indicated by the TEST lamp going out.			20 to 54 units on meter. NORMAL lamp on and FAULT lamps off.
12	Set FUNCTION switch to position 7 and momentarily push the TEST INITIATE switch.			

Table 2-36. Performance Test Standards for Electronic Control Amplifier A8 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
13	Adjust the INPUT control cw (+) until FAULT lamp no. 1 just comes on. NOTE Steps 14 and 15 must be completed before the test set timing circuits times out, indicated by TEST lamp going out.			22 to 40 units on meter when FAULT lamp no. 1 just comes on.
14	Return INPUT control to center position and wait until READY lamp comes on, then, momentarily push the TEST INITIATE switch.			
15	Adjust the INPUT control (-) until FAULT lamp no. 2 just comes on.			22 to 40 units on meter when FAULT lamp no. 2 just comes on.
16	Return INPUT control to center position.			
17	Set FUNCTION switch to position 8 and momentarily push the TEST INITIATE switch. (See figure 2-28).			Note where meter reading falls on graph, figure 2-28, NORMAL lamp on and FAULT lamps off.
18	Set FUNCTION switch to position 9 and momentarily push the TEST INITIATE switch.			Meter reading must be between the limits on graph as determined in step 17. NORMAL lamp on and FAULT lamps off.
19	Set FUNCTION switch to position 10 and momentarily push the TEST INITIATE switch.			11 to 35 units on meter. NORMAL lamp on and FAULT lamps off.

Table 2-36. Performance Test Standards for Electronic Control Amplifier A8 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
20	Set FUNCTION switch to position 11 and momentarily push the TEST INITIATE switch. NOTE An electronic counter may be used in lieu of the stop watch to measure the fault time delay. Connect the electronic counter (set to measure time interval) to the START and STOP connectors on the test set.			19 to 70 units on meter. NORMAL lamp on and FAULT lamps off.
21	Set FUNCTION switch to position 12 and momentarily push the TEST INITIATE switch.			8 to 56 units on meter.
22	With a stopwatch measure the fault time delay. Time measured from the TEST INITIATE switch is depressed until FAULT lamp goes off and NORMAL lamp lights.			Time delay; 7.5 to 8.5 seconds.
	SHUNT SERVO PERFORMANCE TEST			
23	Set SERVO TEST switch to SHUN position.			
24	Set FUNCTION switch to position 1 and momentarily push the TEST INITIATE switch.			Not less than 60 units on meter. NORMAL lamp on and FAULT lamps off.

Table 2-36. Performance Test Standards for Electronic Control Amplifier A8 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
25	Set FUNCTION switch to position 2 and momentarily push the TEST INITIATE switch.			Zero reading on meter. NORMAL lamp on, and FAULT lamps off.
26	Set FUNCTION switch to position 3 and momentarily push the TEST INITIATE switch.			Zero reading on meter. NORMAL lamp on and FAULT lamps off.
27	Set FUNCTION switch to position 4 and momentarily push the TEST INITIATE switch.			17 to 41 units on meter. NORMAL lamp on and FAULT lamps off.
28	Set FUNCTION switch to position 5 and momentarily push the TEST INITIATE switch.			20 to 50 units on meter. NORMAL lamp on and FAULT lamps off.
29	Set FUNCTION switch to position 6 and momentarily push the TEST INITIATE switch.			39 to 75 units on meter. NORMAL lamp on and FAULT lamps off.
30	Repeat steps 12 through 16.			Same as steps 13 and 15.
31	Repeat steps 17 and 18.			Same as steps 17 and 18.
32	Set FUNCTION switch to position 10 and momentarily push the TEST INITIATE switch.			36 to 64 units on meter. NORMAL lamp on and FAULT lamps off.
33	Set FUNCTION switch to position 11 and momentarily push the TEST INITIATE switch. NOTE An electronic counter may be used in lieu of the stopwatch to measure the fault time			26 to 68 units on meter. NORMAL lamp on and FAULT lamps off.

Table 2-36. Performance Test Standards for Electronic Control Amplifier A8 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
33 (Cont)	delay. Connect electronic counter (set to measure time interval) to the START and STOP connectors on the test set.			
34	Set FUNCTION switch to position 12 and momentarily push the TEST INITIATE switch.			25 to 57 units on meter.
35	With a stopwatch measure the fault time delay. Time measured from when TEST INITIATE switch is depressed until FAULT lamp goes out and NORMAL lamp lights.			Time delay; 7.5 to 8.5 seconds.
36	Set POWER switches to OFF and disconnect equipment.			

Table 2-37. 878L-35 Fault Lamp and Meter Vs Fault Conditions

NOTE

Reference to connector J1 applies to connector J1 on servo amplifier card A8 (p/o 490T-8)

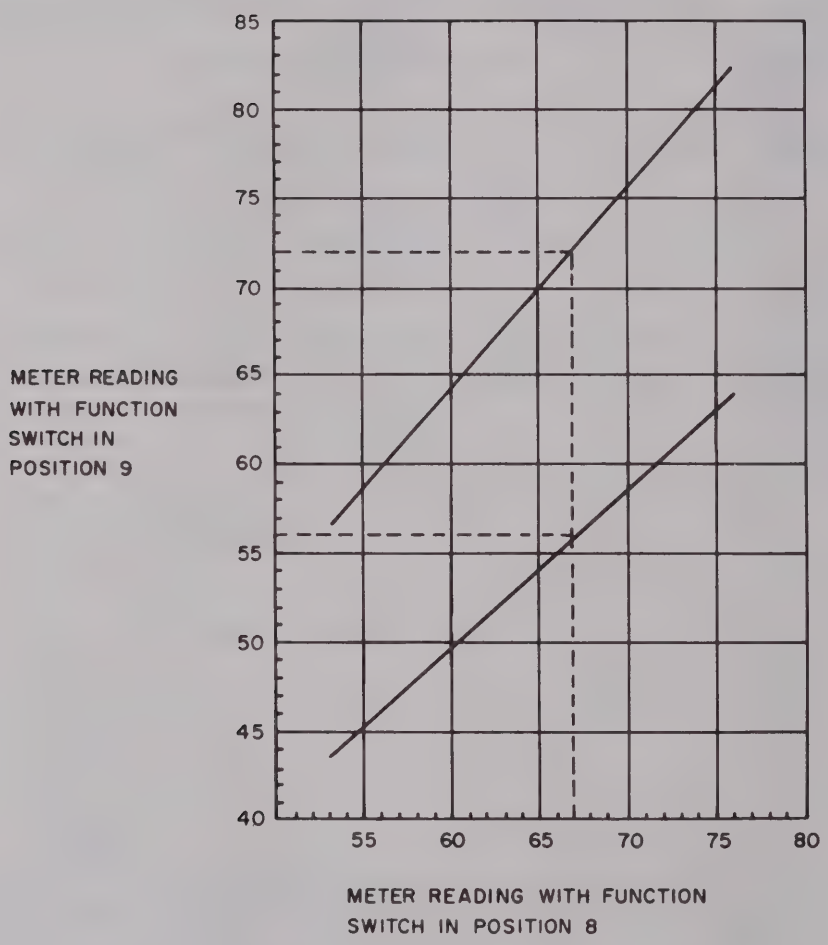
FUNCTION SWITCH	SERIES			SHUNT		
	FLT 1 (ON)	FLT 2 (ON)	MTR (NO INDICATION)	FLT 1 (ON)	FLT 2 (ON)	MTR (NO INDICATION)
1	No gnd	No clock pulse at J1-191	No clock pulse at J1-191	No gnd	No clock pulse at J1-191	No clock pulse at J1-191
2	No servo pwr at J1-161	No + series sense at J1-155	No pwr switching +28 Vdc through 2750 ohms to J1-177	No servo pwr at J1-161	No +5 Vdc	No pwr switching , no ac at J1-150
3	No + series sense at J1-155	No pwr supply current	No pwr switching +28 Vdc through 270 ohms to J1-177	No + shunt sense at J1-181	No pwr supply current	No pwr switching, no ac at J1-150
4	No rf intlk at J1-162	No - series at J1-182	No series servo	Temp fault at J1-165	No +5 Vdc	No shunt servo
5	No - series sense at J1-182 and/or no rf intlk at J1-162	Disregard	No series servo	No - shunt sense at J1-154	Temp fault at J1-165	No shunt servo
6	No gnd	No servo pwr at J1-161	No series servo	No gnd	No +5 Vdc	No shunt servo
7	No + series sense at J1-155	No - series sense at J1-182	No ± variable ac input	No + shunt sense at J1-181	No - shunt sense at J1-154	No ± variable ac input

Table 2-37. 878L-35 Fault Lamp and Meter Vs Fault Conditions (Cont)

FUNCTION SWITCH	SERIES			SHUNT		
	FLT 1 (ON)	FLT 2 (ON)	MTR (NO INDICATION)	FLT 1 (ON)	FLT 2 (ON)	MTR (NO INDICATION)
8	No - series sense at J1-182	No + series sense at J1-155	No 115-Vac line ref	No - shunt sense at J1-154	No + shunt sense at J1-181	No 115-Vac line ref
9	No + series sense at J1-155	No - series sense at J1-182	No pwr switching, ac at J1-177	Arc fault at J1-190	Disregard	No pwr switching, ac at J1-150
10	No gnd	No +5 Vdc	No gain	No gnd	Arc fault at J1-190	No gain
11	No gnd	No +5 Vdc	No gain	No gnd	No +5 Vdc	No gain
12	Time fault at J1-192	No +5 Vdc	No gain	Time fault at J1-192	No +5 Vdc	No gain

EXAMPLE (NOTE DASHED LINES)

FUNCTION SWITCH	METER READING
8	67 UNITS
9	MUST BE BETWEEN 56 AND 72 UNITS



B314 345 3

Figure 2-28. Related Meter Indications for Positions 8 and 9 of FUNCTION Switch (490T-8 Electronic Control Amplifier)

Table 2-38. Performance Test Standards for Power Supply Module A12

TEST EQUIPMENT REQUIRED:

Power Supply Test Set TS-3358/T (878L-33A Power Supply Test Set)
Power Distribution Panel SB-3722/G (255B-1 Power Distribution Panel)
Electronic Frequency Counter, HP-5245L
Digital Voltmeter, Fluke 8300A

PRELIMINARY INSTRUCTIONS:

1. Install power supply module to be tested on the power supply holder (p/o 878L-33A). See figure 2-29. (Include installing the protective plastic cover provided over power supply module.)

2. Using ac power cable provided, connect the 255B-1 to 115-Vac 400-Hz source.

3. Using ac power cable provided, connect the 878L-33A to the 255B-1 (is mounted in carrying case this is already connected).

4. Connect an HP-5245L frequency counter to the BNC jack on the side of the power supply holder.

WARNING

Use caution when working on the power supply module as high voltages (both ac and dc) are exposed at several places.

NOTE

Unless otherwise noted reference to controls and indicator refer to the 878L-33A. only. For test set fault lamp operation vs fault condition of unit under test, refer to table 2-39.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1	On power supply holder, set AC POWER switch to INTL, EXT BLO switch to OFF, and TUNE switch to OPR.			
2	Set 878L-33A POWER switch to OFF and, using 878L-33A test cable W1 connect power supply holder to J1 on the 878L-33A.			

Table 2-38. Performance Test Standards or Power Supply Module A12 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3	Set POWER switches on the 855B-1 and the 878L-33A to the ON position.		NOTE Steps 4 through 6 provide a self-test of the 878L-33A. The self-test capability of the 878L-33A provides a test of the monitor and display circuits.	
4	Set FUNCTION switch to FAULT 1 position.			FAULT 1 lamp lights.
5	Set FUNCTION switch to FAULT 2 position.			FAULT 2 lamp lights.
6	Set FUNCTION switch to NORMAL position. NOTE Allow up to 5 seconds delay time for circuits to reset in each switch position.			NORMAL lamp lights.
7	Slowly rotate the FUNCTION switch through positions 1 through 11.			NORMAL lamp on and FAULT lamps off in each position.
8	Slowly rotate FUNCTION switch through positions 16 through 19.			NORMAL lamp on and FAULT lamps off in each position.
9	Set EXT BLO switch to ON.			External blower on power supply module operates.

Table 2-38. Performance Test Standards or Power Supply Module A12 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
10	After blower reaches maximum speed, approximately 30 seconds, set TUNE switch to TUNE.			Blower stops.
11	Set TUNE switch to OPR.			Blower starts.
12	After blower reaches maximum speed, set EXT BLO switch to OFF and measure the elapsed time that the blower runs.			Blower stops in 2 to 4 seconds.
13	Note frequency indicated on the HP-5245L.			392 to 408 Hz.
14	Set POWER switch to OFF and remove the protective plastic cover from power supply.			
15	Connect one end of a jumper to the junction of CR20 and S2 on power supply. This junction point is identified by a green and brown striped wire connected to one terminal. See figure 2-29.			
16	Replace the protective cover and set POWER switch to ON.			
17	Short the free end of the jumper wire to chassis ground.			Blower starts.

Table 2-38. Performance Test Standards or Power Supply Module A12 (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
18	Set the TUNE switch on power supply holder to TUNE. When blower cuts off, set TUNE switch to OPR. Measure the elapsed time until the EXT BLO lamps 1 and 2 come on.			EXT BLO lamps 1 and 2 light within 8 to 14 seconds.
19	Set all power switches OFF and disconnect equipment.			

Table 2-39. 878L-33A Fault Lamp Vs Fault Condition

FUNCTION SWITCH	FAULT 1 (ON)	FAULT 2 (ON)
1	-5 Vdc: low	-5 Vdc: high
2	—	-5-Vdc ripple: high
3	+5 Vdc: low	+5 Vdc: high
4	—	+5-Vdc ripple: high
5	+28 Vdc prot: low (nom load)	+28 Vdc prot: high (nom load)
6	—	+28-Vdc prot ripple: high (nom load)
7	+28 Vdc prot: low (max load)	+28 Vdc prot: high (max load)
8	—	+28-Vdc prot ripple: high (max load)
9	400-Hz freq: low	400-Hz freq: high
10	+28 Vdc unprot: low	+28 Vdc unprot: high
11	—	28-volt λ/2 wave neg component is too high
12	28-volt λ/2 peak voltage: low (nom load)	28-volt λ/2 peak voltage: high (nom load)
13	28-volt λ/2 peak voltage: low (max load)	28-volt λ/2 peak voltage: high (max load)
14	115 Vac: low (nom load)	115 Vac: high (nom load)
15	115 Vac: low (mac load)	115 Vac: high (max load)
16	Same as position 14	Same as position 14
17	Same as position 15	Same as position 15
18	Same as position 12	Same as position 12
19	Same as position 13	Same as position 13

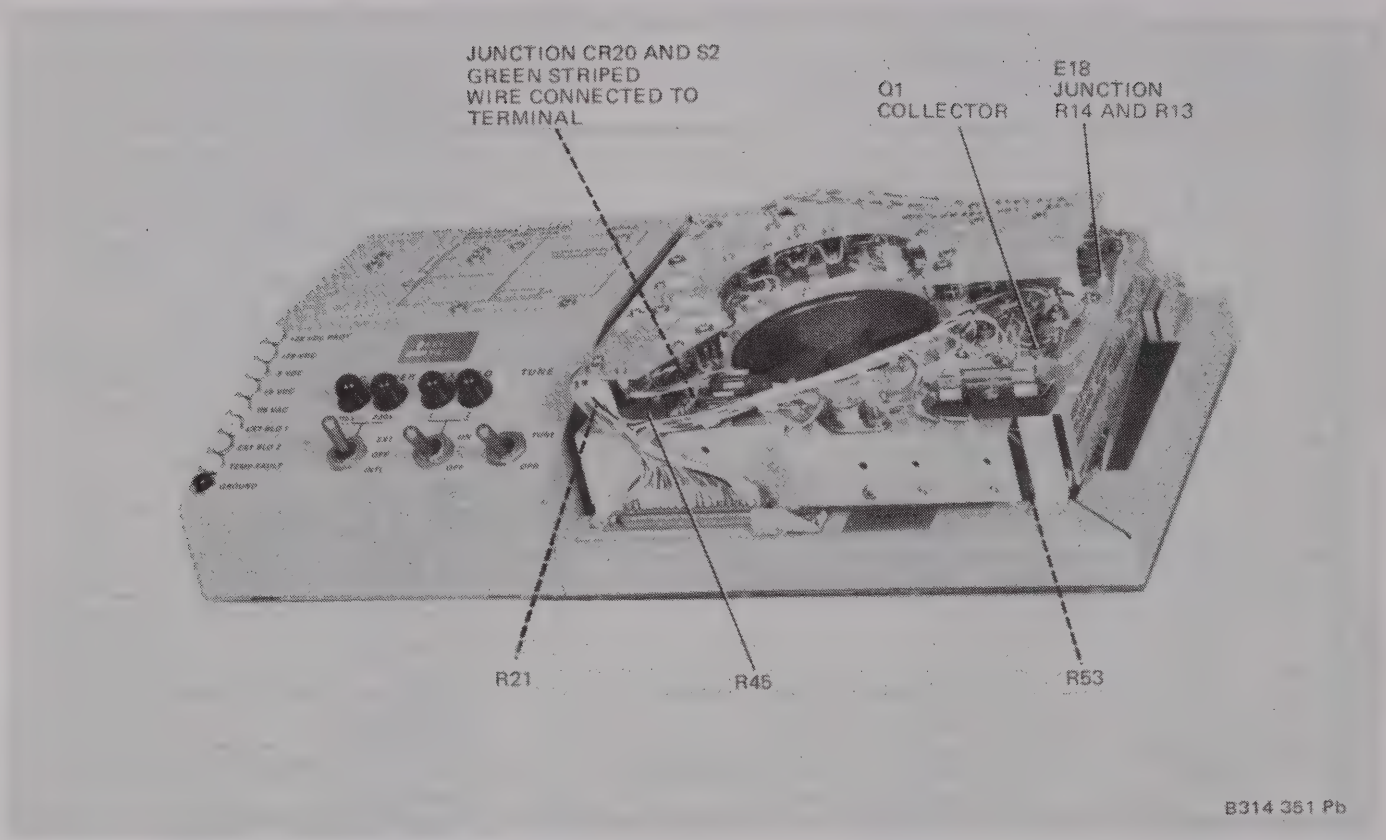


Figure 2-29. 490T-8 Power Supply Module A12 (Mounted on Power Supply Holder) Test Point and Adjustment Location

2-151. CONTROL-MONITOR C-8375/TSC-60(V) (915X-2).

2-152. The following paragraphs provide instructions for special maintenance of Control-Monitor C-8375/TSC-60(V) (915X-2 Control-Monitor). All maintenance instructions are performed while the 915X-2 is connected to the 975K-2 test set. Testing is to a level necessary for fault isolation to an assembly.

2-153. TEST POINTS. Table 2-40 lists the functions of the test points listed for adjustments and in the performance test standards table. The test points listed are located on the 975K-2 test set or on the 915X-2 circuit card connectors.

2-154. PERFORMANCE TESTS. Table 2-41 lists the procedures for performance testing the 915X-2. Perform all steps in the order listed. Continue through the numbered steps until a malfunction is discovered or until the test is complete. If the unit fails to meet a performance standard, use standard troubleshooting procedures to isolate the faulty assembly. After any repair, perform the entire performance test.

Table 2-40. 915X-2 Test Points

TEST POINT	LOCATION	CIRCUIT FUNCTION
A/D	975K-2 Test Set	Voltage monitor
A4P2-30	Circuit card connector	Analog input +
A4P2-31	Circuit card connector	Analog input —
A4P2-35	Circuit card connector	Ground No. 1
A4P1-31	Circuit card connector	Amplifier output
A4P2-19	Circuit card connector	A/D range switch
A4P1-17	Circuit card connector	Logic 1
A4P2-33	Circuit card connector	Logic 0

2-155. ADJUSTMENT PROCEDURES. The following paragraphs provide adjustment procedures for the 915X-2. Figures 2-30 and 2-31 show the locations of adjustments.

2-156. Preliminary Procedures.

a. Remove dust cover and air deflector from 915X-2.

b. Turn off power to 975K-2 and set test function selector to 915X-2.

c. Connect 915X-2 to extender cable CX-12775/TSC-60(V) and connect extender cable to test connector J4 of 975K-2.

d. Use the CX-12777/TSC-60(V) test lead to connect LCU SINE WAVE connector of 7404A-1 to the CONTROL, CLOCK, and MONITOR jacks of the 915X-1/2 TEST PANEL.

e. Set the 915X-1/2 TEST PANEL controls as follows:

DCU ADDRESS (1 through 5) - 10101

UNIT INTLK - NORM

FIL TIME DELAY - 0

DIGITAL MONITOR STATUS - 1

A/D INPUT - 0 VDC

f. Set 975K-2 POWER switch to ON.

g. Set 7404A-1 controls as follows:

DCFE/DCU-LCU-LCU/DCU - LCU (rear panel)

PARITY ENCODE - MANUAL

PARITY MODE - SENSED

RETRANSMIT - CONTINUAL

ADDRESS LENGTH - 5 BIT

MODE - HDX

SINE WAVE/LOGIC LEVEL - SINE WAVE (rear panel)

Bits 0 through 7 - 11010110

Bits 12 through 15 - 1101

Bit 29 - 0

POWER - ON

Press SEND/READY switch twice.

2-157. Adjustments.

a. Adjust A4R1 to midrange (12.5 turns from maximum clockwise position).

NOTE

Resistor A4R2 is not used in AN/TSC-60.

b. Short A4P2-30 and A4P2-31 together.

c. Connect the 8300A digital voltmeter to A4P1-31 and A4P2-35 (card ground), and adjust A4R30 until the 8300A indicates 0 ±0.0001 Vdc.

d. Remove short from A4P2-30 and A4P2-31.

e. Apply logic 1 to A4P2-19 (jumper to A4P1-17).

f. On 975K-2, set A/D INPUT switch to 0.75 VDC. Connect the HP-6104A power supply (set to +1.0000 Vdc) to A4P2-30 (+) and A4P2-31 (-).

g. Voltage at A4P1-31 (on the 8300A) is -5 ±0.25 Vdc. Record exact indication.

h. Remove logic 1 jumper from A4P2-19 and jumper it to logic 0 (A4P2-33).

i. Set the HP-6104A to 10.0000 Vdc.

j. Adjust A4R1 for an indication on the 8300A within 0.00001 Vdc of indication in step g.

k. Remove the HP-6104A from A4P2-30 and A4P2-31 and short these pins together.

l. The 8300A indication should be 0 ±0.200 Vdc. If the 8300A shows other indication, repeat procedure starting at step h.

m. Disconnect the 8300A and connect the 454 oscilloscope to A2P1-34.

n. Set 7404A-1 bit switches 0 through 7 to 11010110 and switches 8 through 31 to 0. Set 7404A-1 RETRANSMIT switch to CONTINUAL.

o. Remove logic 0 jumper from A4P2-19 and connect a logic 1 jumper. (See step e.)

p. Adjust A2R8 so that no ramp output is visible on the 454.

q. Adjust A2R27 so that 7404A-1 lamp 14 is flickering (A/D sign threshold). When adjustment has been properly made, 7404A-1 lamps 16 through 27 will be out also.

r. Remove short from A4P2-30 and A4P2-31.

s. Connect the HP-6104A (set to +0.9995 ±0.0001 Vdc) to A4P2-30 (+) and A4P2-31 (-).

t. Adjust A2R15 so the 7404A-1 flickers between indication of 1.0 volt and 0.999 volt (lamps 16 and 18 on for 1.0 volt, and lamps 16, 19, 20, 23, 24, and 27 on for 0.999 volt).

u. Change the HP-6104A connections to supply -0.9995 ±0.0001 Vdc to A4P2-30(-) and A4P2-31 (gnd).

v. Repeat step t. adjusting A2R20.

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Table 2-41. Performance Test Standards for 915X-2 Control-Monitor

TEST EQUIPMENT REQUIRED:

Test Lead CX-12776/TSC-60(V)
(7404A-1 Test Lead)
Signal Data Indicator-Simulator SM-637/G
(7404A-1 Source Generator Display Unit)
Oscilloscope, Tektronix 454
Digital Voltmeter, Fluke 8300A
Power Supply, HP-6101A
Electronic Circuit Plug-In Unit Test Set
TS-3356/TSC-60(V)
(975K-2 Test Set)

CAUTION

Do not connect or disconnect 915X-2 unless power has been removed from 975K-2.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	DIGITAL MONITOR TEST			
1	a. Set 975K-2 POWER switch to OFF and test function selector to 915X-2. b. Use CX-12776/TSC-60(V) test lead to connect LCU SINE WAVE connector of 7404A-1 to the CONTROL, CLOCK, and MONITOR jacks of the 915X-1/2 test panel. c. Set 915X-1/2 TEST PANEL controls as follows: Control — Position DCU ADDRESS — 1 1 — 1 2 — 0 3 — 1 4 — 0 5 — 1 UNIT INTLK — NORM FIL TIME DELAY — 0 DIGITAL MONITOR STATUS — 1			

Table 2-41. Performance Test Standards for 915X-2 Control-Monitor (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	d. Set 7404A-1 controls as follows: Control — Position DCFE:DCU-LCU-LCU/DCU — LCU (rear panel) PARITY ENCODE — MANUAL PARITY MODE — SENSED RETRANSMIT — OFF ADDRESS LENGTH — 5 BIT MODE — HDX SINE WAVE/LOGIC LEVEL — SINE WAVE (rear panel) Bit Control Switches 0 — 1 1 — 1 2 — 0 3 — 1 4 — 0 5 — 1 6 — 0 7 — 0 e. Plug 915X-2 into test connector J4 of 975K-2. Do not force the unit, but seat it firmly f. Set 975K-2 POWER switch to ON. g. Set 7404A-1 POWER switch to ON and press the CLEAR pushbutton.			

Table 2-41. Performance Test Standards for 915X-2 Control-Monitor (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	h. Press SEND/ READY pushbutton twice on 7404A-1.	7404A-1 monitor lamps 0 1 2 3 4 5 6 7		 Off On Off On Off On Off Off
	ANALOG-TO-DIGITAL CONVERTER TEST			
2	a. On 915X-1/2 TEST PANEL, set DIGITAL MONITOR control to TUNE and A/D INPUT selector to 0 Vdc. b. Set 7404A-1 bit control switch 6 to 1 and switches 7 through 31 to 0. c. Press 7404A-1 SEND/READY push-button twice. d. On 915X-1/2 TEST PANEL, set A/D INPUT selector to +0.75 VDC. e. Set 7404A-1 bit control switches 13 and 15 up (first 1-volt range address). f. Press 7404A-1 SEND/READY push-button twice.	7404A-1 monitor lamps 16 through 25		Off

Table 2-41. Performance Test Standards for 915X-2 Control-Monitor (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	g. Connect the 8300 8300A between points of test.	A/D (+) COMMON (-)		Record voltage measurement.
	h. Refer to table 2-42. Read 7404A-1 monitor lamp display (lamps 16-27).			Voltage reading within ±1% of measured value of step 2g.
	i. Set 7404A-1 bit control switches to the remaining 1-volt range address settings (bits 12-15) shown in table 2-42. There are six more settings.			See step 2j.
	j. Press 7404A-1 SEND/READY push-button twice after each new setting.			Same as step 2h. for each new setting.
	k. Set 7404A-1 bit control switches as follows (first 10-volt range address): Switch — Position 6 — 1 7 — 0 8-31 — 0			
	l. On 915X-1/2 TEST PANEL, set A/D INPUT selector to +5.25 VDC. Press 7404A-1 SEND/READY pushbutton twice.			
	m. Connect the 8300A to points of test.	A/D (+) COMMON (-)		Record voltage measurement.

Table 2-41. Performance Test Standards for 915X-2 Control-Monitor (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	n. Refer to table 2-42. Read 7404A-1 monitor lamp display (lamps 16-27).	7404A-1 monitor lamps		Voltage reading within ±1% of measured value of step 2m.
	o. Set 7404A-1 bit control switches to the remaining 10-volt range address settings shown in table 2-42. (There are eight more settings.)			See step 2p.
	p. Press the 7404A-1 SEND/READY button twice after each new setting.			Same as step 2n. after each new setting.
	q. Set 7404A-1 bit switches 12-15 down.			
	r. On 915X-1/2 TEST PANEL, set A/D INPUT control to +12.50 VDC. Press 7404A-1 SEND/ READY pushbutton twice.			
	s. Connect the 8300A between points of test.	A/D (+) COMMON (-)		Record voltage measurement.
	t. Refer to table 2-42. Read 7404A-1 monitor lamp display.	7404A-1 monitor lamps		Lamp 15 on and voltage within ±1% of measurement of step 2s.
	u. On 915X-1/2 TEST PANEL, set A/D INPUT control to -9.25 VDC. Press 7404A-1 SEND/READY pushbutton twice.			
	v. Connect the 8300A between points of test.	A/D (-) COMMON (+)		Record voltage measurement.

Table 2-41. Performance Test Standards for 915X-2 Control-Monitor (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	w. Refer to table 2-42. Read 7404A-1 monitor lamp display.	7404A-1 monitor lamps	NOTE If steps 2a. through 2w. failed, adjust per paragraph 2-155, then return to step 2a.	Lamp 15 off, lamp 14 on. Voltage reading within ±1% of measurement of step 2v.
	x. Set 7404A-1 bit control switch 10 to 1 (A/D inhibit). On 915X-1/2 TEST PANEL, set A/D INPUT control to +5.25 VDC.			
	y. Press 7404A-1 SEND/READY push-button twice.	7404A-1 monitor lamps		Same lamp display as step 2w.

Table 2-42. Interpretation of A/D Converter Monitor Word on 7404A-1 Display

7404A-1 MONITOR LAMP NO.		VALUE [( ) values are 1-volt range]	RANGE ADDRESS SETTINGS 7404A-1 BIT SWITCHES 12—15				
			12	13	14	15	RANGE
14	SIGN		0	0	0	0	10V
15	OVERRANGE (10)	10 (1)	0	0	0	1	10V
16	ONES (TENTHS)	8 (0.8)	0	0	1	0	10V
17		4 (0.4)	0	0	1	1	10V
18		2 (0.2)	0	1	0	0	10V
19		1 (0.1)	0	1	0	1	1V
20	TENTHS (HUNDREDTHS)	0.8 (0.08)	0	1	1	0	1V
21		0.4 (0.04)	0	1	1	1	1V
22		0.2 (0.02)	1	0	0	0	1V
23		0.1 (0.01)	1	0	0	1	1V
24	HUNDREDTHS (THOUSANDTHS)	0.08 (0.008)	1	0	1	0	1V
25		0.04 (0.004)	1	0	1	1	1V
26		0.02 (0.002)	1	1	0	0	10V
27		0.01 (0.001)	1	1	0	1	10V
			1	1	1	0	10V
			1	1	1	1	10V

Example:

15	16	17	18	19	20	21	22	23	24	25	26	27
0	0	1	1	1	0	1	0	1	0	0	0	0
	7				5				0			

10-volt range reading: 7.5 Vdc
1-volt range reading: 0.750 Vdc

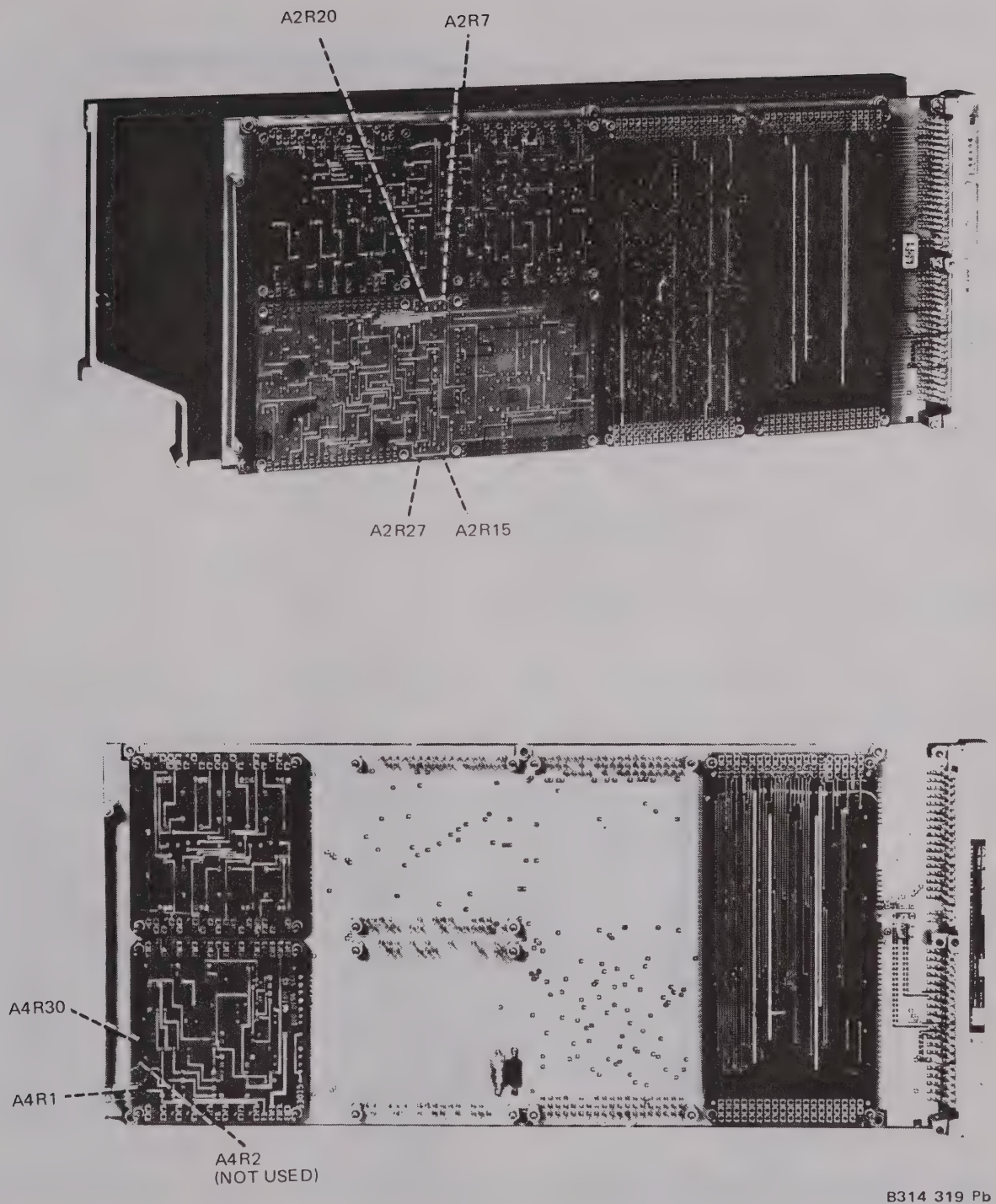


Figure 2-30. 915X-2 Control-Monitor, Adjustment Points Location (Early Models)

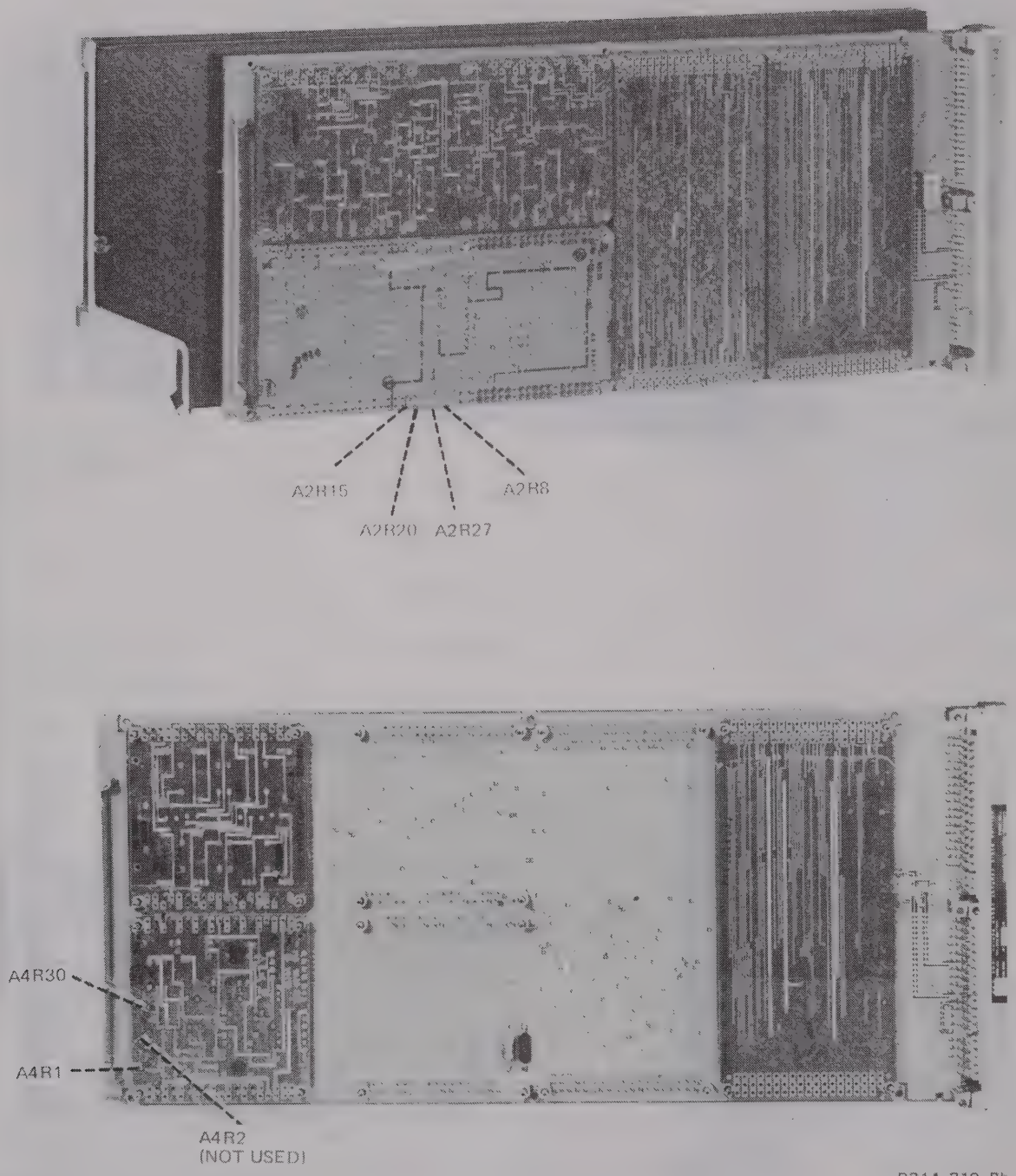


Figure 2-31. 915X-2 Control-Monitor, Adjustment Points Location (Later Models)

2-158. RADIO FREQUENCY AMPLIFIER AM-4699/ARC-132 (648A-1P).

2-159. The following paragraphs provide instructions for special maintenance of Radio Frequency Amplifier AM-4699/ARC-132 (Power Amplifier 648A-1P). For an alternate method of testing the 648A-1P using the TS-3785/TSC-60(V), refer to T.O. 33D7-25-42-1.

2-160. TEST POINTS. Table 2-43 lists the function of the test points listed for adjustments and in the performance test standards table.

2-161. PERFORMANCE TESTS. Table 2-44 lists the procedures for performance testing the 648A-1P. Perform all steps in order listed. Continue through the numbered steps until a malfunction is discovered or until the test is completed. If the unit fails to meet a performance standard, use standard troubleshooting procedures to isolate the faulty assembly. After any repair, perform the entire performance test.

2-162. Driver Cathode Neutralization.

a. Remove the cover from the 648A-1P.

b. Remove the metal side cover from A2 module and replace with the fabricated metal test cover (figure 2-32) with feedback switch S9 closed.

c. Connect the 648A-1P to the hot mockup rack using the CX-12772/TSC-60(V) extender cable and the blower assembly.

d. Connect the C-8828/TSC-60(V) switching box to J1 through J6 of card A9.

e. Set the switching box to position 1.

f. Set the transmitter control on the hot mockup to 27.0 MHz.

g. Disconnect the exciter output on the rf patch panel and connect the output from the HP-606A signal generator through the CU-2017/TSC-60 signal generator coupler to the pa input on the rf patch panel. Set HP-606A to 27 MHz.

h. Tune the pa through step 6. Keep the rf drive from the HP-606A low enough so the power output does not exceed 200 watts.

i. Unkey the pa and set the transmitter control to STBY. Ground A12TP7.

j. Disconnect the HP-606A from the pa input.

k. Ground P1-81 on the extender cable.

l. Connect rf millivoltmeter through a 1.0-pf capacitor (CM04CD010D03) to the driver grid end of C88 (in the A2 module).

m. Without adjusting signal generator frequency, connect the HP-606A to extender pin 141 (rf output).

n. Adjust the output from the HP-606A for an indication on the rf millivoltmeter (any convenient level).

o. Using a nonmetallic tool, adjust A2L3 for a peak on the rf millivoltmeter (not a final adjustment, just peaking the circuit).

p. Adjust A2A1C115 for a null on the rf millivoltmeter.

q. Disconnect the test equipment and reassemble the 648A-1P.

2-163. PA Neutralization.

a. Repeat steps a. through h. of paragraph 2-162.

b. Unkey the pa and set the transmitter control to STBY.

c. Ground A12TP7.

d. Remove fabricated test cover for A2, open the switch cover for A2S9, and replace fabricated test cover.

e. Disconnect the HP-606A from the pa input.

f. Ground extender cable pin 81.

WARNING

Be sure the transmitter control stays in the STBY position so high voltage is not applied to the A2 module.

g. Connect the HP-606A to extender cable pin 141 (rf output).

h. Connect the C3 lead of the fabricated neutralizing detector (figure 2-34) to the pa grid at A2S3A-5 and the plain lead to neutralizing ring (metal ring mounted on S3 switch stack).

i. Connect the 8300A digital voltmeter to the output points on the fabricated detector (must be floating meter).

j. Adjust the HP-606A output level for no less than 0.5-m Vdc indication on the 8300A.

k. Using a non-metallic tool, manually rotate roller in A2L3 to peak the 8300A indication (not a final adjustment).

l. Remove 648A-1P and extender from blower assembly and turn the 648A-1P on its side. Remove 648A-1P bottom tube compartment shield.

m. Adjust A2C83 slightly.

n. Note the HP-606A level for reference.

o. Disconnect neutralizing detector from A2.

p. Put the 648A-1P back on blower assembly and repeat steps a. through i.

q. Set the HP-606A to reference level of step n.

r. Repeat steps k. through m. until the minimum 8300A indication is obtained.

s. Recheck the driver cathode neutralization.

t. Disconnect all test equipment and reassemble the 648A-1P.

Table 2-43. 648A-1P Test Points

TEST POINT	LOCATION	CIRCUIT FUNCTION
R66 and C94 junction	A2	+5 Vdc
R61 and C24 junction	A2	Input amplifier current
L20 and C24 junction	A2	Input amplifier current
Q1-D	A2A1	Rf in analog
P2-37	A2	Coarse tune voltage

See Supp C
2-164 Replacing R.F Coils

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier

TEST EQUIPMENT REQUIRED:

HF Signal Generator, HP-606A
Signal Generator Coupler CU-2017/TSC-60(V)
Digital Voltmeter, Fluke 8300A
Communication Central Training Set AN/TSC-60(V)1-T2 (hot mockup)
Test Cover for 648A-P Module A2 (See figure 2-32) for fabrication details.)
Electronic Equipment Air Cooler HD-906/TSC-60(V) (Blower Assembly)
Electrical Special Purpose Cable Assembly CX-12772/TSC-60(V) (648A-1P Extender Cable)
Remote Switching Control C-8828/TSC-60(V) (Switching Box)
True RMS Millivoltmeter, Ballantine 340
Radio Receiver, Collins 51S-1
Neutralizing Detector (See figure 2-34 for fabrication details.)
RF Vector Impedance Meter, HP-4815A
Electronic Voltmeter, HP-410C

PRELIMINARY INSTRUCTIONS:

1. Remove the dust cover from the 648A-1P.

2. Remove the side cover from the A2 module and replace with fabricated side cover. (Refer to figure 2-32.)

3. Connect the CX-12772/TSC-60(V) extender cable to the equipment rack and attach to the blower assembly.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1			WARNING ← See Supp 2 CAUTION The blower assembly must be operating when power is applied to the 648A-1P. (1) Turn on the applicable pa and exciter circuit breakers on the hot mockup. (2) Set the XMIT PWR switch to STBY and press INITIATE button on the transmitter control.	

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
		INPUT AMPLIFIER CURRENT TEST		
2	a. Connect the 8300A across the points of test.	Junction of R66 and C94 and chassis. (Refer to figure 6-11 in T.O. 31R2-2ARC-132-2.)		+4.8 to +5.1 Vdc across the points of test
	b. Connect the 8300A across points of test and chassis.	R61 and C24 junction (CI72255 and above)		+0.33 to +0.52 Vdc
		L20 and C24 junction (below CI72255)		+0.35 to +0.58 Vdc NOTE If the voltage does not fault within the limits, replace R66 with a new select value.
		RF INPUT DETECTOR TEST		
3	a. Connect the HP-606A output through the CU-2017/TSC-60 signal generator coupler to extender cable pin 81. b. Set the HP-606A to 2 MHz with zero output. c. Connect the 8300A across the points of test.	Junction of A2A1Q-1D and R56 and chassis		Note dc voltage reading.

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3 (Cont)	d. Adjust the HP-606A output to 0.3 Vrms. e. Repeat steps 3b. through 3d. at 15.0 and 30.0 MHz.			Reading increases at least 0.1 Vdc.
	BANDSWITCH SYNC CIRCUIT TEST			
4	a. Connect the C-8828/TSC-60(V) switching box to J1 through J6 of 648A-1P card A9. b. Set the switching box to position 1.		(1) Set the transmitter to a frequency within 2.5 to 3.1 MHz and press the INITIATE button. (2) Set the transmitter to a frequency within 24.0 to 29.9 MHz and press the INITIATE button. (3) Set the transmitter to a frequency within 2.5 and 3.1 MHz and press the INITIATE button.	Rotor contact on switch S1 is directly under (centered) stator contact 4. Refer to figure 2-33 for contact location. NOTE If S1 stator and rotor are not aligned properly, loosen mounting bracket for switch S8. Rotate mounting bracket slightly (counterclockwise to retard S1 rotor position), and tighten S8 mounting bracket, being careful not to induce side thrust.

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)			(4) When the bandswitch motor stops running, set the XMTR PWR switch to STBY. (5) Repeat steps 4b(1) through 4b(4) until S1 is properly aligned.	Check the alignment of S1 stator and rotor.
COARSE POSITIONING VOLTAGE CIRCUIT TEST				
5	a. Set the switching box to OFF position.		(1) Set the transmitter to a frequency within 2.0 to 2.4 MHz and press the INITIATE button. (2) Turn off the applicable power amplifier and exciter circuit breaker and remove the A2 module from the 648A-1P. (3) Manually rotate roller coil for L3 to the minimum inductance end stop (roller coil nearest pa tube sockets).	
	b. Connect the HP-6104A across A2P2-39 and chassis and adjust power supply for +20-Vdc output.			
	c. Connect the 8300A across points of test.	A2P2-37 and chassis		+3.21 to +3.55 Vdc
			(4) Replace the A2 module; set exciter and pa circuit breakers to on.	

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)			(5) Repeat steps 5(1) through 5(4) for the following frequencies.	
			Band 2 (2.5 to 3.1 MHz)	+6.19 to +6.85 Vdc
			Band 3 (3.2 to 3.9 MHz)	+8.49 to +9.39 Vdc
			Band 4 (4.0 to 4.9 MHz)	+10.17 to +11.24 Vdc
			Band 5 (5.0 to 6.1 MHz)	+11.40 to +12.66 Vdc
			Band 6 (6.2 to 7.6 MHz)	+12.26 to +13.55 Vdc
			Band 7 (7.7 to 9.5 Vdc)	+13.25 to +14.65 Vdc
			Band 8 (9.6 to 11.9 MHz)	+14.07 to +15.55 Vdc
			Band 9 (12.0 to 14.9 MHz)	+14.83 to +16.39 Vdc
			Band 10 (15.0 to 18.9 MHz)	+15.46 to +17.08 Vdc
			Band 11 (19.0 to 23.9 MHz)	+16.03 to +17.71 Vdc
			Band 12 (24.0 to 29.9 MHz)	+16.59 to +18.33 Vdc
	INPUT AMPLIFIER GAIN TEST			
6	a. Set the HP-606A to 2.0 MHz. b. Connect the 340 to the output from the HP-606A and extender cable pin 81 with a tee-connector. c. Adjust the HP-606A for 0.5 Vrms on the 340. d. Using the 340, measure the output at the junction of A2C88 and A2C1.	A2C88 and A2C1 junction	Set the XMIT control to STBY.	No less than 0.77 Vrms.

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	e. Repeat steps c. and d. at the following frequencies of the HP-606A.			
	5.0			No less than 0.79 Vrms.
	10.0			No less than 0.75 Vrms
	15.0			No less than 0.76 Vrms
	20.0			No less than 0.84 Vrms
	25.0			No less than 0.99 Vrms
	29.9999			No less than 0.99 Vrms
	POWER AMPLIFIER GAIN AND CATHODE CURRENT BALANCE TEST			
7	a. Disconnect the HP-606A from the extender cable and reconnect the extender jumper to pin 81.		(1) Set system frequency to 2 MHz, at HIGH PWR, and momentarily key.	
	b. Reconnect the HP-606A to pin 81 of the extender cable.		(2) Key the transmitter and leave it keyed.	
	c. Adjust the HP-606A (at 2 MHz) for 1-kW output from the pa.			
	d. Set the hot mock-up maintenance display to check the RF INPUT, PA CATHODE CURRENT 1 and 2.			RF INPUT is 2.5 to 3.5. PA CATHODE CURRENT 1 and 2 each are 5.40 to 5.60 and not more than 10% unbalanced.
	e. Repeat steps a. through d. at the following frequencies:			Same as step d. for each frequency.
	2.5 MHz 3.2 MHz 4.0 MHz 5.0 MHz			

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
7 (Cont)	6.2 MHz 7.7 MHz 9.6 MHz 12.0 MHz 15.0 MHz 19.0 MHz 24.0 MHz 29.9999 MHz			NOTE If the preceding results were not obtained, check the following possibilities: Defective tubes Poor dynamic balance of tubes (usually indicated by large amount of pa cathode unbalance under drive). Improper neutralization (usually indicated by too much pa cathode current in higher bands). As a last resort, test select driver tank load resistors R18 and R19.
	DETECTOR FREQUENCY RESPONSE TEST			
8	a. Disconnect HP-606A from extender and reconnect jumper to pin 81. b. Reconnect HP-606A to pin 81 of the extender. Set HP-606A to 29.9999 MHz. c. Set the switch on the CU-2017/TSC-60 to IN position.		(1) Set transmitter control to 29.9999 MHz, HIGH PWR, and momentarily key.	

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

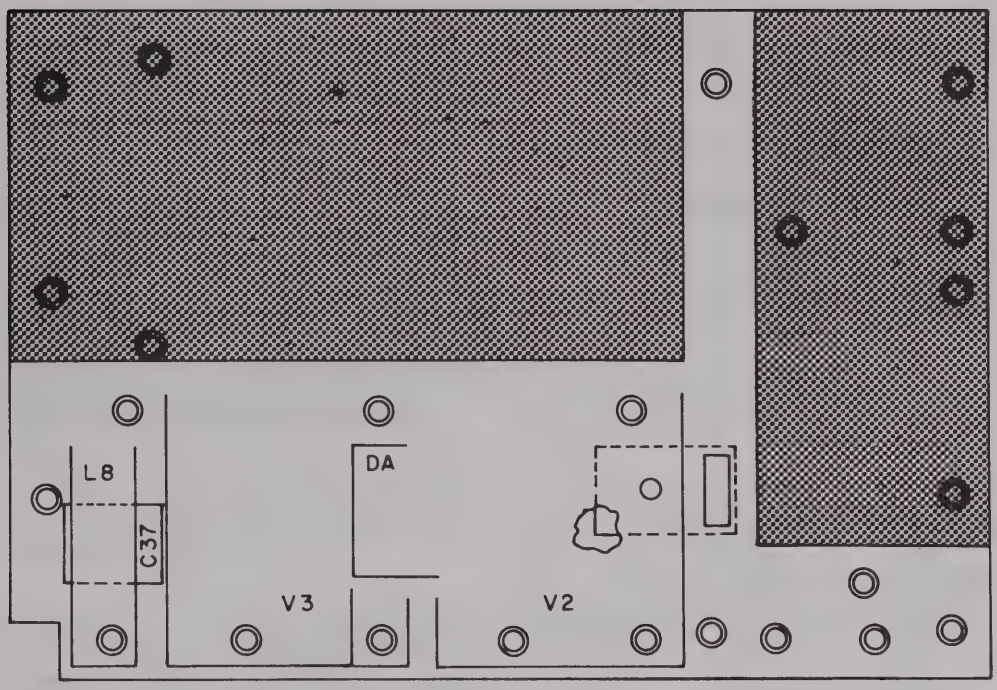
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
8 (Cont)	d. Connect the HP-410C across CU-2017/TSC-60 jacks.			
	e. Increase HP-606A output until the HP-410C indicates -2.5 Vdc.		(2) Key the transmitter.	900- to 1100-watt output from pa. NOTE Adjust A3R10 as explained in the 648A-1P Alc/Tgc adjustment procedures in T.O. 31S1-2TSC60-12. If A3R10 and stop is reached, adjust A2C39.
	f. Repeat steps a. through e. at the following frequencies: 24.0 MHz 15.0 MHz 7.7 MHz 2.0 MHz		(3) Unkey transmitter.	
	PA LOADING ADJUSTMENT TEST			
9	a. Set the switching box to position 1. b. Set the HP-606A to 2.0 MHz with 1.0-Vrms output. c. Manually tune to step 6 using switching box.		(1) Set transmitter control to 2 MHz. (2) Key transmitter. (3) Ground 648A-1P A12TP7 and set transmitter to STBY.	

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
9 (Cont)	d. Connect the output of the HP-606A (do not change frequency) to the EXT OSC IN connection of the HP-4815A.			
	e. Set HP-606A for 100-mV output.		(4) Remove the side plate from A2 and manually close interlock switch S6. (5) Discharge the pa plate circuit.	
	f. Connect the HP-4815A to the pa plate circuit.			800 to 1200 ohms at -10° to +10°. NOTE If the preceding indication was not obtained, adjust A3R17. To obtain the correct indication, the procedure must be repeated each time A3R17 is adjusted.
	FEEDBACK CIRCUIT TEST			
10	a. Set the switching box to OFF position.		(1) Replace the fabricated test cover on A2 module with switch S9 open. (2) Manually close switch S9 on A2 and tune the transmitter at 2.0 MHz, keyed.	
	b. With S9 closed, adjust the HP-606A for 1-kW output from the pa.			Note the dB indication on the HP-606A.

Table 2-44. Performance Test Standards for 648A-1P Power Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
10 (Cont)	c. With S9 open, adjust the HP-606A for 1-kW output from the pa.			7 to 12 dB difference from step b.
	d. Repeat steps a. through c. for following frequencies: 7.7 MHz 15.0 MHz 24.0 MHz 29.9999 MHz			Same as steps b. and c. plus not more than 3-dB variation between any two frequencies.
	e. Disconnect all test equipment.			
	f. Replace side cover on A2 and dust cover on 648A-1P.			



NOTE:

FABRICATED FROM COLLINS PART NUMBER 775-2354-001, REMOVE MATERIAL IN SHADED AREA.

Figure 2-32. Test Cover for 648A-1P Module A2

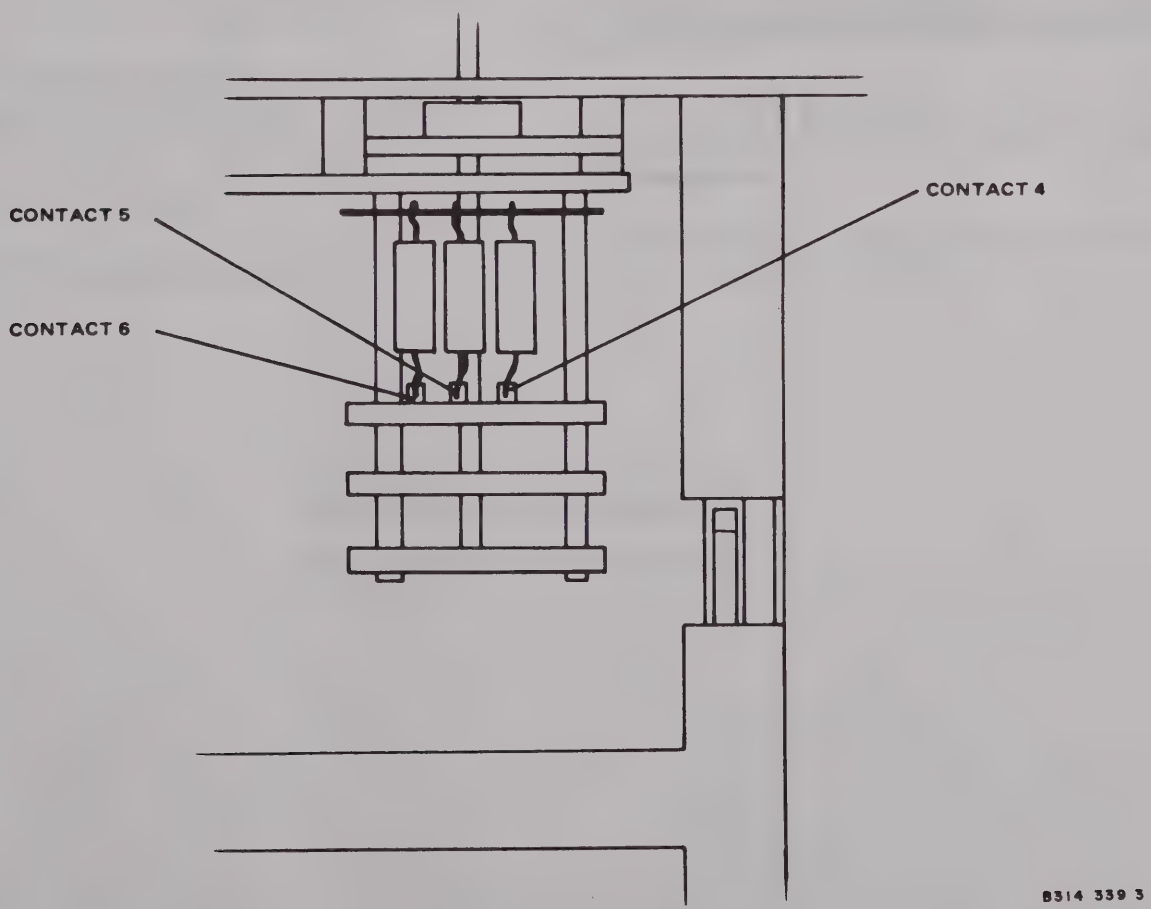
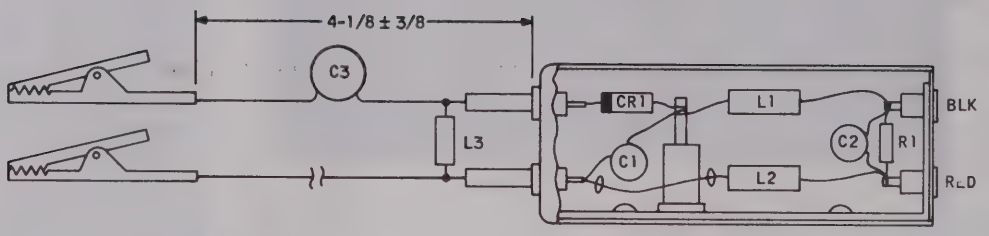


Figure 2-33. Switch S1 Contact Location



NEUTRALIZING DETECTOR LIST OF PARTS		
PART	CPN	MIL P/N
C1,C2	913-1186-000	CK60AW102M
C3	913-3681-000	825-213X5V0104Z
L1,L2,&L3	240-0198-000	BS217
CR1	353-0160-000	1N198
R1	745-1436-000	RC20GF104K
EXT TERMS	357-9469-000	201-8
INT TERM	306-1018-000	TF300
RED JACK	360-0139-000	72-140-2
BLK JACK	360-0137-000	72-140-0
CLIPS	362-0016-000	30
CAN	548-8010-004	N/A
ENTIRE ASSEMBLY WITHOUT C3 AND L3 IS 548-3533-005		

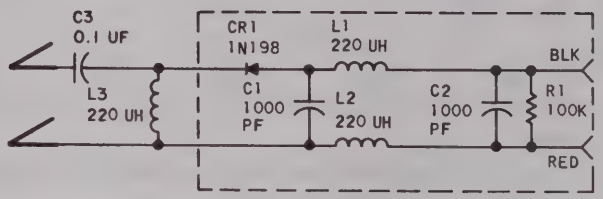


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Figure 2-34. Neutralizing Detector

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2-164. DIGITAL-TO-ANALOG CONVERTER CV-2674/TSC-60(V) (309F-1 DIGITAL-TO-ANALOG CONVERTER).

2-165. The following paragraphs provide instructions for special maintenance of Digital-to-Analog Converter CV-2674/TSC-60(V) (309F-1 Digital-to-Analog Converter). All maintenance instructions are performed while the 309F-1 is connected to Electrical Circuit Plug-In Unit Test Set TS-3356/TSC-60(V) (975K-2 test set). Testing is to a level necessary for fault isolation to an assembly.

2-166. TEST POINTS. Table 2-45 lists the functions of the test points listed for adjustments and in the performance test standards table. All test points are located on the 975K-2 test set.

2-167. PERFORMANCE TESTS. Table 2-46 lists the procedures for performance testing the 309F-1. Peform all steps in the order listed. Continue through the numbered steps until a malfunction is discovered or until the test is completed. If the unit fails to meet a performance standard, use standard troubleshooting procedures to isolate the faulty assembly. After any repair, perform the entire performance test.

2-168. ADJUSTMENT PROCEDURES. The following paragraphs provide adjustment for the 39F-1. Figure 2-35 shows locations of adjustments.

2-169. Preliminary Procedures.

a. Remove the dust cover of the 309F-1.

b. Turn off POWER switch on 975K-2 and set test function selector to 309F-1.

c. Perform steps 1, 2a., and 2b. of table 2-46.

2-170. Adjustments.

a. Set potentiometer A1R5 (upper of the three potentiometers located at lower front edge of unit) to provide indication of 20 ±0.01 Vdc on the 8300A.

b. On 309F-1 TEST PANEL, set COARSE POSITION FREQUENCY to 15.0 MHz.

c. Connect the 8300A between 0 VDC (-) and POT LO (+) test points on 309F-1 TEST PANEL.

d. Set potentiometeer A1R18 (center of the three potentiometers) to provide indication of 4.76 ±0.01 Vdc on the 8300A.

e. Connect the 8300A between 0 VDC (-) and +30 VDC (+) test points on 309F-1 TEST PANEL.

f. Set potentiometer A1R19 (bottom of the three potentiometers) to provide indication of 29.6 ±0.01 Vdc on the 8300A.

g. Due to slight interaction, it is necessary to repeat steps c. through f. until the voltages are within limits simultaneously.

h. Turn off power to 975K-2, disconnect the 8300A, and replace dust cover on 309F-1.

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Table 2-45. 309F-1 Test Points

TEST POINT	LOCATION	CIRCUIT FUNCTION
+30 VDC	309F-1 TEST PANEL	D/A power supply test
+20 VDC	309F-1 TEST PANEL	D/A power supply test
0 VDC	309F-1 TEST PANEL	D/A power supply test
-20 VDC	309F-1 TEST PANEL	D/A power supply test
POT-HI	309F-1 TEST PANEL	D/A power supply test
POT-LO	309F-1 TEST PANEL	D/A power supply test
CLOCK	309F-1 TEST PANEL	Oscilloscope sync
PWR INTERRUPT	309F-1 TEST PANEL	Output monitor
GND	309F-1 TEST PANEL	Test set common

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Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter

TEST EQUIPMENT REQUIRED:

Digital Voltmeter Fluke 8300A
Electronic Circuit Plug-In Unit Test Set TS-3356/TSC-60(V) (975K-2 Test Set)

CAUTION

Do not connect or disconnect the 309F-1 unless the POWER switch has been switched off on the 975K-2.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	PRELIMINARY SETUP			
1	a. Set 975K-2 POWER switch to OFF and test function selector to 309F-1. b. Set 309F-1 TEST PANEL controls as follows: OUTPUT MONITOR 1 — OFF OUTPUT MONITOR 2 — OFF FAULT SIMULATION selector — OFF FAULT SIM switch — OFF CONTROL SENSOR INPUT — H V ENABLE MANUAL SERVO CONTROL — OFF TUNE SEQUENCE MANUAL STEP — 2 TUNE SEQUENCE MODE switch — MAN AUX KEY — OFF MANUAL SERVO MODE — CRS			

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	c. Plug the 309F-1 into test connector J5 of 975K-2. Do not force the unit, but seat it firmly. d. Set the 975K-2 POWER switch to ON and allow 309F-1 to operate for 15 minutes.			
	D/A POWER SUPPLY TEST			
2	a. On 309F-1 TEST PANEL, set COARSE POSITION FREQUENCY to 15.0 MHz and press TUNE START/FAULT RESET switch. b. Connect the 8300A between points of test. c. On 309F-1 TEST PANEL, set COARSE POSITION FREQUENCY to 2.0 MHz and press TUNE START/FAULT RESET switch.	+20 VDC (Hi) to -20 VDC (Lo)		+20.00 ±0.01 Vdc NOTE If the performance standard of step 2b. is not met, proceed to paragraph 2-168 and complete adjustment procedures before continuing the tests of this table. When adjustments are complete, continue.

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	d. Connect the 8300A between points of test.	0 Vdc (Lo) and POT LO (Hi)		+4.76 ±0.01 Vdc
		0 Vdc (Lo) and +30 VDC (Hi)		+29.60 ±0.01 Vdc
	e. Set COARSE POSITION FREQUENCY to each of the following frequencies. For each setting, press TUNE START/FAULT RESET switch and observe the 8300A reading.	POT LO (Lo) and GND (Hi)		
	2.0 MHz			+ 1.3 ±0.5 Vdc
	6.9 MHz			+ 4.6 ±0.5 Vdc
	9.9 MHz			+ 6.6 ±0.5 Vdc
	15.0 MHz			+10.0 ±0.5 Vdc
	19.6 MHz			+13.1 ±0.5 Vdc
	25.5 MHz			+17.0 ±0.5 Vdc
	29.9 MHz			+20.0 ±0.5 Vdc
	PRIOR TUNE FAULT OUTPUTS TEST			
3	a. Set 309F-1 TEST PANEL controls as follows: OUTPUT MONITOR 1 — BLO ENBL OUTPUT MONITOR 2 — ATR PWR CONT CONTROL SENSOR INPUT — OFF TUNE SEQUENCE MODE — MAN			

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3 (Cont)	b. Connect the 8300A to points of test.	PWR INTERRUPT (+) to GND (-)		Logic 1 (+3.0 to +5.0 Vdc)
	c. Set FAULT SIMULATION selector to CKT BRKR INTLK.	FAULT IND		Off
	d. Set FAULT SIMULATION selector to ACCESS/PLUG FLT.	FAULT IND		Off
		MON 1 IND		Off
		MON 2 IND		Off
	e. Set CONTROL SENSOR INPUT selector to FIL ENABLE.	MON 1 IND		On
		MON 2 IND		On
	f. Set OUTPUT MONITOR 1 selector to FIL ENBL.	MON 1 IND		On
	g. Set FAULT SIM switch to FAULT, then back to OFF.	FAULT IND		On
		MON 1 IND		Off
		MON 2 IND		Off
	h. Set OUTPUT MONITOR 1 selector to BLO ENBL.	MON 1 IND		Off
	i. Press TUNE START/FAULT RESET switch.	FAULT IND		Off
		MON 1 IND		On
		MON 2 IND		On
	j. Set OUTPUT MONITOR 1 to FIL ENBL.	MON 1 IND		On

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3 (Cont)	k. Set FAULT SIMULATION selector to CKT BRKR INTLK.			
	l. Set FAULT SIM switch to FAULT, then back to OFF.	FAULT IND		On
		MON 1 IND		Off
		MON 2 IND		Off (delayed)
	m. Set OUTPUT MONITOR 1 selector to BLO ENBL.	MON 1 IND		Off
	n. Press TUNE START/FAULT RESET switch.	FAULT IND		Off
		MON 1 IND		On
		MON 2 IND		On
	o. Set OUTPUT MONITOR 1 selector to FIL ENBL.	MON 1 IND		On
	p. Set FAULT SIMULATION selector to AIR/TEMP INTLK. Set FAULT SIM switch to FAULT.	MON 1 IND		Off
		MON 2 IND		Off
	q. Set OUTPUT MONITOR 1 selector to BLO ENBL.	MON 1 IND		On
	r. Set FAULT SIM switch to OFF.	FAULT IND		Off
		MON 1 IND		On
		MON 2 IND		On
	s. Set OUTPUT MONITOR 1 selector to FIL ENBL.	MON 1 IND		On

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3 (Cont)			NOTE Read steps 3t. through 3x., then do them quickly.	
	t. Set CONTROL SENSOR INPUT selector to OFF.	MON 1 IND MON 2 IND		Off Off
	u. Set OUTPUT MONITOR 1 selector to BLO ENBL.	MON 1 IND		Off
	v. Set CONTROL SENSOR INPUT selector to HV ENABLE.			
	w. Set OUTPUT MONITOR 1 selector to HV ENBL.			
	x. Set OUTPUT MONITOR 2 selector to FIL TIMER.	MON 2 IND MON 1 IND		On for 25 to 40 seconds, then goes out. Turns on when MON 2 IND turns off.
TUNE SEQUENCE AUXILIARY FUNCTIONS TEST				
4	a. Set OUTPUT MONITOR 1 selector to PA KEY.			
	b. Set TUNE SEQUENCE MODE to AUTO.			
	c. Press TUNE START/FAULT RESET switch.	TUNE STEP lamps A B C TUNE FAULT		 On Off Off Off

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	d. Set TUNE SEQUENCE MODE to MAN.			
	e. Set OUTPUT MONITOR 1 selector to each of the following positions:			
	PA KEY	MON 1 IND		Off
	TUNE PWR	MON 1 IND		On
	TGC/ALC	MON 1 IND		On
	DRVR SVO MODE	MON 1 IND		On
	PRI SVO MODE	MON 1 IND		On
	SEC SVO MODE	MON 1 IND		On
	LDG SVO MODE	MON 1 IND		On
	f. Set OUTPUT MONITOR 2 selector to each of the following positions:			
	TUNE COMPL	MON 2 IND		On
	PA READY	MON 2 IND		On
	DRVR SVO ENABLE	MON 2 IND		On
	PRI SVO ENABLE	MON 2 IND		On
	SEC SVO ENABLE	MON 2 IND		On
	LDG SVO ENABLE	MON 2 IND		On
	TGC INHIBIT OUT	MON 2 IND		On
	g. Set OUTPUT MONITOR 1 selector to KEY MON.			
	h. Set TUNE SEQUENCE MODE to AUTO. Press TUNE FAULT/FAULT RESET button.			

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	i. Set CONTROL SENSOR INPUT selector to KEY ENABLE.	MON 1 IND		On
		TUNE STEP		
		A		On
		B		On
		C		Off
	j. Set CONTROL SENSOR INPUT selector to SVO RUN SENSOR.			
	k. Set OUTPUT MONITOR 1 selector to TUNE RELAY CONT.	MON 1 IND		On
		TUNE STEP		
		A		Off
		B		On
		C		On
			NOTE If TUNE FAULT lamp lights during the procedure, press TUNE START/FAULT RESET button whenever necessary to clear fault.	
	l. Set CONTROL SENSOR INPUT selector to RF PROVE and OUTPUT MONITOR 2 selector to TGC INHIBIT OUT.	MON 2 IND		Off
		TUNE STEP		
		A		Off
		B		On
		C		On
	m. Set CONTROL SENSOR INPUT selector to PA TUNE and OUTPUT MONITOR 1 selector to OPER REQUEST.	MON 1 IND		Off
		TUNE STEP		
		A		On
		B		Off
		C		On

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	n. Set CONTROL SENSOR INPUT selector to EXCTR TUNE/OPR and OUTPUT MONITOR 1 selector to TGC/ALC.	MON 1 IND		Off
		TUNE STEP		
		A		On
		B		On
		C		On
	o. Set OUTPUT MONITOR 2 selector first to TUNE COMPL and then to PA READY.	MON 2 IND		Off for both positions.
	p. Set CONTROL SENSOR INPUT selector to HV ENABLE and OUTPUT MONITOR 1 selector to KEY MON.	MON 1 IND		Off
		MON 2 IND		On
	q. Set AUX KEY switch to ON.	MON 1 IND		On
		MON 2 IND		On
	r. Set CONTROL SENSOR INPUT selector to EXCTR TUNE/OPR, then momentarily back to PA TUNE, then back to EXCTR TUNE/OPR.	TUNE STEP		
		A		On
		B		Off in PA TUNE, then on
		C		On
	TUNE SEQUENCE FAULTS/ENABLES TEST			
5	a. Set OUTPUT MONITOR 2 selector to DRVR SVO ENABLE.			
	b. Momentarily set SERVO ENABLE switch to ON.	MON 2 IND		Off for 4 to 7 seconds.
	c. Set OUTPUT MONITOR 2 selector to PRI SVO ENABLE.			

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	d. Momentarily set SERVO ENABLE switch to ON.	MON 2 IND		Off for 4 to 7 seconds.
	e. Set OUTPUT MONITOR 2 selector to SEC SVO ENABLE.			
	f. Momentarily set SERVO ENABLE switch to ON.	MON 2 IND		Off for 4 to 7 seconds.
	g. Set OUTPUT MONITOR 2 selector to LDG SVO ENABLE.			
	h. Momentarily set SERVO ENABLE switch to ON.	MON 2 IND		Off for 4 to 7 seconds.
	i. Momentarily set DEMAND SURV switch to ON.	MON 2 IND		Off for 4 to 7 seconds.
	j. Set OUTPUT MONITOR 1 selector to HV ENBL.	MON 1 IND		On
	k. Set FAULT SIMULATION selector to PL CUR O/L and set FAULT SIM switch to FAULT and back to OFF.	MON 1 IND FAULT IND		Off On
	l. Press TUNE START/FAULT RESET switch.	MON 1 IND FAULT IND		On Off
	m. Set FAULT SIMULATION selector to SCRN CUR O/L and set FAULT SIM switch to FAULT and back to OFF.	FAULT IND MON 1 IND		On Off

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	n. Set OUTPUT MONITOR 1 selector to PA KEY.	MON 1 IND		Off
	o. Press TUNE START/FAULT RESET switch.	FAULT IND		Off
		MON 1 IND		On in 3 to 5 seconds.
	p. Set OUTPUT MONITOR 1 selector to HV ENBL.			
	q. Set CONTROL SENSOR INPUT selector to FIL ENABLE.	MON 1 IND		Off
	r. Set OUTPUT MONITOR 1 selector to PA KEY.	MON 1 IND		Off
	s. Set CONTROL SENSOR INPUT selector to EXCTR TUNE/OPR.			
	t. Press TUNE START/FAULT RESET switch.	MON 1 IND		On in 3 to 5 seconds.
	u. Set FAULT SIMULATION selector to VSWR O/L and set FAULT SIM switch to FAULT and back to OFF.	MON 1 IND		Off
		FAULT IND		On
	v. Press TUNE START/FAULT RESET switch.	MON 1 IND		On in 3 to 5 seconds.
		FAULT IND		Off
	w. Set FAULT SIMULATION selector to ANTENNA INTLK and FAULT SIM switch to FAULT.	MON 1 IND		Off

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	x. Set FAULT SIM switch to OFF.	MON 1 IND		On
	y. Set CONTROL SENSOR INPUT selector to RF PROVE and press TUNE START/ FAULT RESET switch.	TUNE FAULT		On in 15 to 35 seconds.
	z. Set CONTROL SENSOR INPUT selector to EXCTR TUNE/ OPR and press TUNE START/FAULT RESET switch.	TUNE FAULT		Off
	TUNE SEQUENCE SEQUENTIAL MONITORS TEST			
6	a. Set 309F-1 TEST PANEL controls as follows:	TUNE STEP		
	MANUAL SERVO MODE — CRS	A		On
	TUNE SEQUENCE MODE — MAN	B		Off
	MANUAL STEP — 1	C		Off
	MANUAL SERVO CONTROL — SVO ACT/SVO DISABLE			
	b. Set OUTPUT MONITOR 1 selector to each of the following positions:			
	TUNE RELAY CONT	MON 1 IND		Off
	DRVR SVO MODE	MON 1 IND		On
	PRI SVO MODE	MON 1 IND		On
	SEC SVO MODE	MON 1 IND		On
	LDG SVO MODE	MON 1 IND		On

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	c. Set OUTPUT MONITOR 2 selector to each of the following positions:			
	DRVR SVO ENABLE	MON 2 IND		On
	ERR MON REQ DRVR	MON 2 IND		On
	PRI SVO ENABLE	MON 2 IND		On
	ERR MON REQ PRI	MON 2 IND		On
	SEC SVO ENABLE	MON 2 IND		On
	ERR MON REQ SEC	MON 2 IND		On
	LDG SVO ENABLE	MON 2 IND		On
	ERR MON REQ LDG	MON 2 IND		On
	d. Set TUNE SEQUENCE MANUAL STEP selector to 2. Set MANUAL SERVO CONTROL to SVO ACT/SVO ENABLE.	TUNE STEP		
		A		On
		B		On
		C		Off
	e. Repeat step 6b. and then go to step 6f.			
	f. Set OUTPUT MONITOR 2 selector to each of the following positions:			
	DRVR SVO ENABLE	MON 2 IND		Off
	ERR MON REQ DRVR	MON 2 IND		On
	PRI SVO ENABLE	MON 2 IND		Off
	ERR MON REQ PRI	MON 2 IND		On
	SEC SVO ENABLE	MON 2 IND		Off
	ERR MON REQ SEC	MON 2 IND		On
	LDG SVO ENABLE	MON 2 IND		Off
	ERR MON REQ LDG	MON 2 IND		On

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	g. Set CONTROL SENSOR INPUT selector to PA TUNE, MANUAL STEP selector to 3, and MANUAL SERVO MODE to FINE.	TUNE STEP		
		A		Off
		B		On
		C		Off
	h. Set OUTPUT MONITOR 1 selector to each of the following positions:			
	TUNE RELAY CONT	MON 1 IND		Off
	DRVR SVO MODE	MON 1 IND		Off
	PRI SVO MODE	MON 1 IND		Off
	SEC SVO MODE	MON 1 IND		Off
	LDG SVO MODE	MON 1 IND		Off
	i. Set OUTPUT MONITOR 2 selector to the following positions:			
	DRVR SVO ENABLE	MON 2 IND		Off
	PRI SVO ENABLE	MON 2 IND		Off
	SEC SVO ENABLE	MON 2 IND		Off
	LDG SVO ENABLE	MON 2 IND		On
	TGC INHIBIT OUT	MON 2 IND		On
	j. Set MANUAL STEP selector to 4.	TUNE STEP		
		A		Off
		B		On
		C		On
	k. Set OUTPUT MONITOR 1 selector to TUNE RELAY CONT.	MON 1 IND		Off
	l. Set MANUAL STEP selector to 5 and CONTROL SENSOR INPUT selector to RF PROVE	MON 1 IND		On

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)		TUNE STEP		
		A		Off
		B		Off
		C		On
	m. Set MANUAL STEP selector to 6.	TUNE STEP		
		A		On
		B		Off
		C		On
	n. Set OUTPUT MONITOR 2 selector to each of the following positions:			
	DRVR SVO ENABLE	MON 2 IND		Off
	PRI SVO ENABLE	MON 2 IND		Off
	SEC SVO ENABLE	MON 2 IND		Off
	LDG SVO ENABLE	MON 2 IND		Off
	o. Set MANUAL SERVO CONTROL to ERR MON/SVO DISABLE.			
	p. Set OUTPUT MONITOR 2 selector to each of the following positions:			
	DRVR SVO ENABLE	MON 2 IND		On
	ERR MON REQ DRVR	MON 2 IND		Off
	PRI SVO ENABLE	MON 2 IND		On
	ERR MON REQ PRI	MON 2 IND		Off
	SEC SVO ENABLE	MON 2 IND		On
	ERR MON REQ SEC	MON 2 IND		Off
	LDG SVO ENABLE	MON 2 IND		On
	ERR MON REQ LDG	MON 2 IND		Off

Table 2-46. Performance Test Standards for 309F-1 Digital-to-Analog Converter (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	q. Set MANUAL SERVO CONTROL to ERR MON/SVO ENABLE.			
	r. Set OUTPUT MONITOR 2 selector to each of the following positions:			
	ERR MON REQ DRVR	MON 2 IND		On
	ERR MON REQ PRI	MON 2 IND		On
	ERR MON REQ SEC	MON 2 IND		On
	ERR MON REQ LDG	MON 2 IND		On
	s. Set MANUAL STEP selector to 7.	TUNE STEP		
		A		On
		B		On
		C		On
	t. Set 975K-2 POWER switch to OFF.			
	u. Disconnect the 309F-1 from 975K-2.			

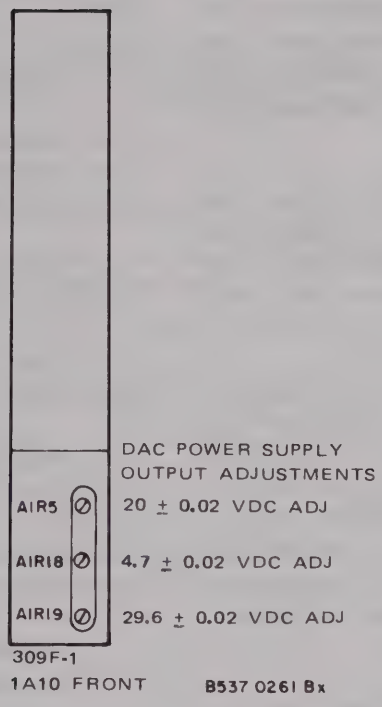

Figure 2-35. Location of 309F-1 Adjustment Points

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2-171. POWER SUPPLY PP-6542/TSC-60(V) (652J-13 POWER SUPPLY).

2-172. The following paragraphs provide instructions for special maintenance and adjustment of Power Supply PP-6542/TSC-60(V) (652J-13 Power Supply). All maintenance instructions are performed while the 652J-13 is connected to the 975K-2 test set. Testing is to a level necessary for fault isolation to an assembly.

2-173. TEST POINTS. Table 5-137 lists the functions of the test points listed for adjustments and in the performance test standards table. The test points listed are located on the 975K-2 test set.

2-174. PERFORMANCE TESTS. Table 5-138 lists the procedures for performance testing the 652J-13. Perform all steps in the order listed. Continue through the numbered steps until a malfunction is discovered or until the test is completed. If the unit fails to meet a performance standard, use standard troubleshooting procedures to isolate the faulty assembly. After any repair, perform the entire performance test.

2-175. ADJUSTMENT PROCEDURES. The following paragraphs provide adjustment procedures for the 652J-13. Figure 2-36 shows locations of adjustments.

2-176. Preliminary Procedures.

a. Remove dust cover from 652J-13.

b. Perform preliminary instructions of table 2-48.

2-177. Adjustments.

a. Connect the 8300A digital voltmeter to +5 V and COMMON test points on 652J-13 TEST PANEL of 975K-2.

b. Adjust R8 to obtain an 8300A indication of +4.995 to 5.005 Vdc.

c. Connect the 8300A to +12 V and COMMON test points on 652J-13 TEST PANEL.

d. Adjust R19 to obtain an 8300A indication of +11.99 to 12.01 Vdc.

e. Connect the 8300A to -12 V and COMMON test points of 652J-13 TEST PANEL.

f. Adjust R30 to obtain an 8300A indication of -11.99 to -12.01 Vdc.

g. Disconnect the 8300A, turn off 975K-2, and disconnect 652J-13 from 975K-2.

h. Replace dust cover on 652J-13.

Table 2-47. 652J-13 Test Points

TEST POINT	LOCATION	CIRCUIT FUNCTION
LOAD MONITOR	652J-13 TEST PANEL	+5-Vdc test point
+5 V	652J-13 TEST PANEL	+12-Vdc test point
+12 V	652J-13 TEST PANEL	-12-Vdc test point
-12 V	652J-13 TEST PANEL	-12-Vdc test point
COMMON	652J-13 TEST PANEL	Test set ground

Table 2-48. Performance Test Standards for 652J-13 Power Supply

TEST EQUIPMENT REQUIRED:

Digital Voltmeter, Fluke 8300A
True RMS Voltmeter, HP-3400A
Power Supply, HP-6104A
Electronic Circuit Plug-In Unit Test Set TS-3356/TSC-60(V) (975K-2 Test Set)
Electrical Special Purpose Cable Assembly CX-12766/TSC-60(V) (333H-2, 599Z-1, 652J-13 Extender Cable)

PRELIMINARY INSTRUCTIONS:

1. Set 975K-2 POWER switch to OFF and set test function selector to 652J-13.
2. Plug the 652J-13 into 975K-2 test connector J2. Do not force the unit, but seat it firmly. On 652J-13 TEST PANEL, set all LOAD ENABLE switches to ON.
3. Set 975K-2 POWER switch to ON and allow 652J-13 to operate for 10 minutes.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
		OUTPUT VOLTAGE TESTS		
1	a. Connect the 8300A to points of test.	LOAD MONITOR +5V and COMMON (-)		+4.995 to +5.005 Vdc. NOTE If the voltage measured in step 1a. is outside performance standards, proceed to paragraph 2-175 and adjust or repair the unit before continuing the tests of this table.
		LOAD MONITOR +12V and COMMON (-)		+11.99 to 12.01 Vdc.
		LOAD MONITOR -12V and COMMON (+)		-11.99 to -12.01 Vdc

Table 2-48. Performance Test Standards for 652J-13 Power Supply (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	b. Connect the 3400A between points of test.	LOAD MONITOR +5V and COMMON		Not more than 5mVrms.
		LOAD MONITOR +12V and COMMON		Not more than 10 mVrms
		LOAD MONITOR -12V and COMMON		Not more than 10 mVrms.
	OVERVOLTAGE CROWBAR TEST			
2	a. Set 975K-2 POWER switch to OFF and disconnect 652J-13 from test connector J2. b. Connect 652J-13 to the CX-12766/ TSC-60(V) extender cable. c. Connect the HP-6104-A to +5-Vdc output test points on extender cable. Do not connect other end of extender cable to 975K-2. d. Set HP-6104A current limiting for 1A. e. Connect the 8300A to HP-6104A output. f. Increase HP-6104A output voltage until current limiting occurs.	TP32 (+) and TP37 (com)		Current limiting occurs at not more than +6.5-Vdc input.

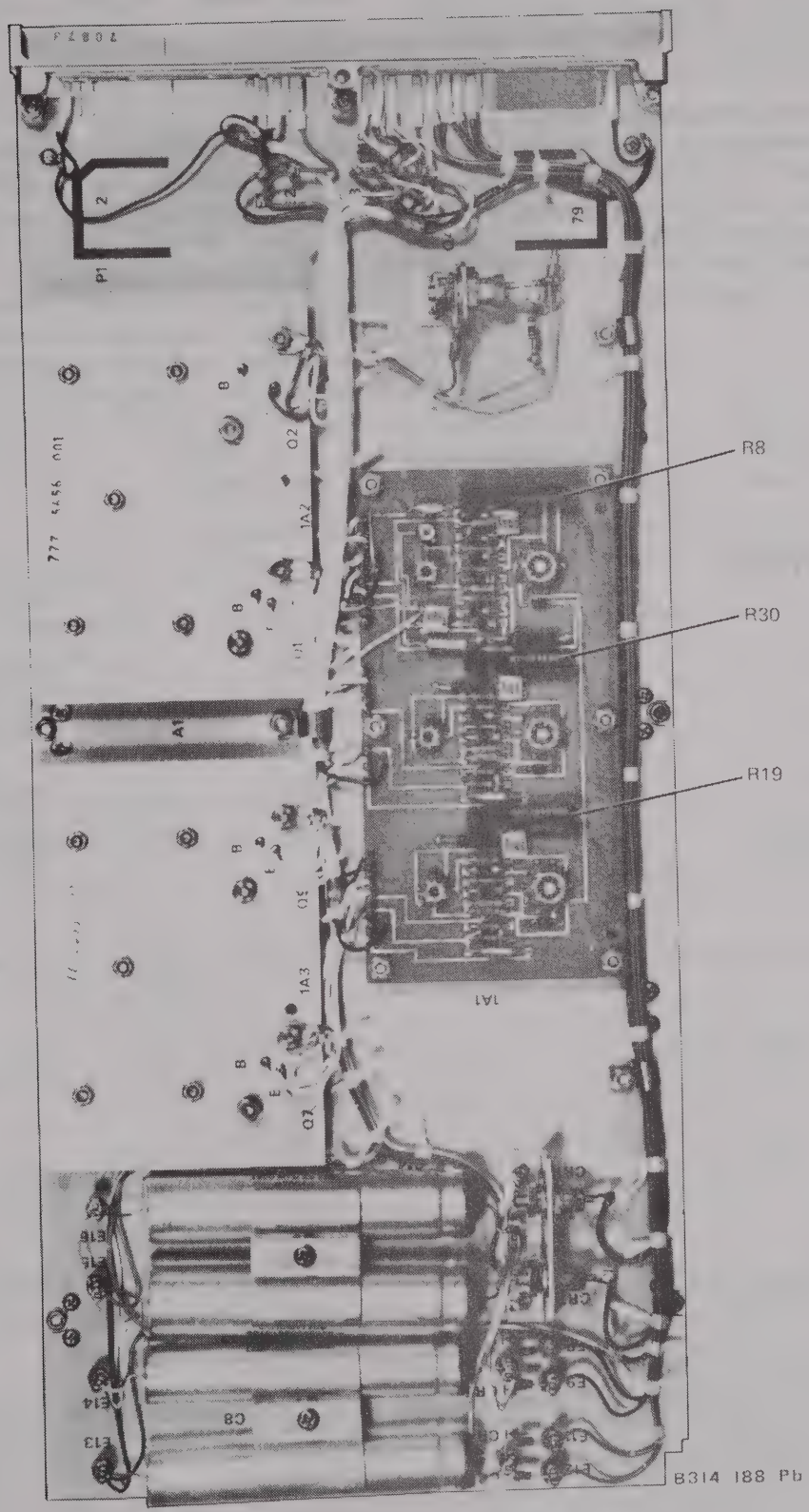

Figure 2-36. 652J-13 Power Supply, Adjustment Points Location

2-178. ELECTRONIC CONTROL AMPLIFIER AM-6229/TSC-60(V) (333H-2 ELECTRONIC CONTROL AMPLIFIER).

2-179. The following paragraphs provide instructions for special maintenance of Electronic Control Amplifier AM-6229/TSC-60(V) (333H-2 Electronic Control Amplifier). All maintenance instructions are performed while the 333H-2 is connected to the 975K-2 test set. Testing is to a level necessary for fault isolation to an assembly.

2-180. TEST POINTS. Table 2-49 lists the functions of the test points listed in the performance test standards table. All test points are located on the 975K-2 test set.

2-181. PERFORMANCE TESTS. Table 2-50 lists the procedures for performance testing the 333H-2. Perform all steps in the order listed. Continue through the numbered steps until a malfunction is discovered or until the test is completed. If the unit fails to meet a performance standard, use standard troubleshooting procedures to isolate the faulty assembly. After any repair, perform the entire performance test.

Table 2-49. 333H-2 Test Points

TEST POINT	LOCATION	CIRCUIT FUNCTION
TP1	333H-2 TEST PANEL	Interlock test
TP2	333H-2 TEST PANEL	Interlock test
TP3	333H-2 TEST PANEL	Amplifier test
TP4	333H-2 TEST PANEL	Amplifier test

Table 2-50. Performance Test Standards for 333H-2 Electronic Control Amplifier

TEST EQUIPMENT REQUIRED:

Electronic Circuit Plug-In Unit Test Set TS-3356/TSC-60(V) (975K-2 Test Set)
Digital Voltmeter Fluke 8300A

PRELIMINARY INSTRUCTIONS:

1. Set 975K-2 POWER switch to OFF and set test function selector to 333H-2.
2. On 333H-2 TEST PANEL, set AMPLIFIER SELECTOR to AMPLIFIER A1.
3. Plug the 333H-2 into 975K-2 test connector J1. Do not force the unit, but seat it firmly.
4. Set 975K-2 POWER switch to ON.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	AMPLIFIER A1 TESTS			
1	a. Set the AMPLIFIER SELECTOR on the 333H-2 TEST PANEL to AMPLIFIER A1. Set the INPUT SELECTOR to + FORCING.			
	b. Connect the 8300A to the points of test on the 652J-13 TEST PANEL.	TP3 (+) and TP4 (—)		
	c. Note the 8300A indication.	TP3 (+) and TP4 (-)		No less than +25 Vdc.
	d. Set the INPUT SELECTOR to -200 MV ERROR.	TP3 (+) and TP4 (-)		No more than +1 Vdc.
	e. Momentarily hold the SERVO ENABLE switch ON.	TP3 (+) and TP4 (-)		No less than +25 Vdc.
	f. Set the INPUT SELECTOR to -50 MV ERROR.	TP3 (+) and TP4 (-)		No more than +1 Vdc.
	g. Momentarily hold the SERVO ENABLE switch ON.	TP3 (+) and TP4 (-)		+7 to +11 Vdc.

Table 2-50. Performance Test Standards for 333H-2 Electronic Control Amplifier (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	h. Set the INPUT SELECTOR to NULL and hold the SERVO ENABLE switch ON.	TP3 (+) and TP4 (-)		No more than +1 Vdc.
	i. Set the INPUT SELECTOR to +50 MV ERROR.	TP3 (+) and TP 4 (-)		No more negative than -1 Vdc.
	j. Momentarily hold the SERVO ENABLE switch ON.	TP3 (+) andTP4 (-)		-7 to -11 Vdc.
	k. Set the INPUT SELECTOR to +200 MV ERROR.	TP3 (+) and TP4 (-)		No more negative than -1 Vdc.
	l. Momentarily hold the SERVO ENABLE switch ON.	TP3 (+) and TP4 (-)		More negative than -25 Vdc.
	m. Set the INPUT SELECTOR to -FORCING.	TP3 (+) and TP4 (-)		More negative than -25 Vdc.
	AMPLIFIERS A2, A3, AND A4 TESTS			
2	Repeat test 1 for AMPLIFIER SELECTOR positions AMPLIFIER A2, AMPLIFIER A3, and AMPLIFIER A4.	TP3 (+) and TP4 (-)		Same as test 1.
	INTERLOCK TEST			
3	a. Shut 975K-2 POWER switch OFF.			
	b. Connect 8300A (ohms scale) between points of test on the 652J-13 TEST PANEL.	TP1 and TP2		Continuity.
	c. Disconnect the 8300A disconnect 333H-2 from 975K-2.			

2-182. AMPLIFIER CONTROL C-8365/TSC60-(V) (915V-1 AMPLIFIER CONTROL).

2-183. The following paragraphs provide instructions for special maintenance of Amplifier Control C-8365/TSC-60(V) (915V-1 Amplifier Control). All maintenance instructions are performed while the 915V-1 is connected to the 975K-2 test set. Testing is to a level necessary for fault isolation to an assembly.

2-184. TEST POINTS. Table 2-51 lists the functions of the test points listed for adjustments and in the performance test standard table.

2-185. PERFORMANCE TESTS. Table 2-52 lists the procedures for performance testing the 915V-1. Perform all steps in the order listed. Continue through the numbered steps until a malfunction is discovered or until the test is completed. If the unit fails to meet a performance standard, use standard troubleshooting procedures to isolate the faulty assembly. After any repair, perform the entire performance test.

2-186. ADJUSTMENT PROCEDURES. The following paragraphs provide adjustment procedures for the 915V-1. Figure 2-37 shows locations of adjustments.

2-187. Preliminary Procedures.

a. Remove 915V-1 dust cover.

b. Turn off power to 975K-2 and set test function selector to 915V-1/2.

c. Set 915V-1/2 TEST PANEL controls as follows:

SERVO SYSTEM to DRIVER

SERVO INPUT to CRS MODE

PWR INTERLOCK to ON

FREQUENCY MHZ to 2

d. Connect 915V-1 to 975K-2 test connector J3 and set 975K-2 POWER switch to ON.

2-188. Voltage Shaper Adjustments.

a. Connect the 8300A digital voltmeter to TP1 (-) and TP2 (+) (figure 2-37). Adjust A1R73 for 21.6 ±0.01 Vdc. (The 8300A must be ungrounded.)

b. Connect the 8300A negative probe to +4.7 VDC test jack on 975K-2 and the 8300A positive probe to CRS SHAPING OUTPUT jack.

c. Adjust potentiometer A1R52 to obtain voltage listed in table 2-53.

NOTE

Voltage values of table 2-53 in ( ) are for A1 cards CI71443 and above; other voltages listed are for A1 cards below CI71443.

d. Set 975K-2 SERVO SYSTEM selector to PRIMARY and adjust potentiometer A1R49 to obtain voltage listed in table 2-53.

e. Set 975K-2 SERVO SYSTEM selector to SECONDARY and adjust potentiometer A1R50 to obtain voltage listed in table 2-53.

f. Set 975K-2 SERVO SYSTEM selector to LOADING and adjust potentiometer A1R51 to obtain voltage listed in table 2-53.

g. Set FREQUENCY MHZ selector to 28 with SERVO SYSTEM selector in SECONDARY. Adjust A1R38 to obtain 18.65 to 19.25 (18.36 to 18.92) Vdc.

h. Set FREQUENCY MHZ selector to 2 with SERVO SYSTEM selector in DRIVER. Return to step a. and recheck voltage. If adjustment of A1R73 is required, repeat steps a. through g. until all voltages are within limits.

i. Set FREQUENCY MHZ selector to 28. Connect the 8300A as in step b. and operate SERVO SYSTEM selector to each of the four positions. In each position, verify that voltage limits of table 2-53 are met (make no adjustments).

j. If limits of step i. are not met, repeat the entire procedure and adjust voltages toward upper or lower limits to allow all requirements to be met.

2-189. Metering Amplifier Adjustments.

CAUTION

In the procedure that follows, it is necessary to remove cards A6 and A7 from the 915V-1 sideboard in order to adjust potentiometers A5R3 and A5R24. Remove power from the 915V-1 before removing or replacing these cards.

a. Remove power from the 915V-1 and remove cards A6 and A7 from the sideboard.

b. Set 975K-2 AMPLIFIER/OVERLOAD CIRCUIT TEST selector to CUR AMPL 1 and set POWER switch to ON.

c. Connect the 8300A to AMPL/OVERLOAD INPUT jack (+) and AMPL/OVERLOAD COM (-).

d. Adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control to obtain -0.15 Vdc.

e. Connect the 8300A to AMPL/OVERLOAD OUTPUT (+) and AMPL/OVERLOAD COM (-).

f. Adjust potentiometer A5R3 (nearest the lower connector) to obtain +0.15 ±0.005 Vdc.

g. Set 975K-2 AMPLIFIER/OVERLOAD CIRCUIT TEST selector to CUR AMPL 2.

h. Adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control for +0.15 Vdc at AMPL/OVERLOAD INPUT jack (+) and COM (-).

i. Adjust potentiometer A5R24 (upper of the two potentiometers) to obtain +1.5 ±0.01 Vdc at AMPL/OVERLOAD OUTPUT jack (+) and COM (-).

j. Remove power from 915V-1 and replace cards A6 and A7.

k. Repeat performance test of table 2-52.

Table 2-51. 915V-1 Test Points

TEST POINT	LOCATION	CIRCUIT FUNCTION
AMPL/OVERLOAD INPUT	915V-1/2 TEST PANEL	Amplifier and sensor input voltage monitor
AMPL/OVERLOAD OUTPUT	915V-1/2 TEST PANEL	Amplifier and sensor output voltage monitor
AMPL/OVERLOAD COM	915V-1/2 TEST PANEL	Amplifier and sensor test common
0 VDC	915V-1/2 TEST PANEL	0-Vdc (floating) output
+4.7 VDC	915V-1/2 TEST PANEL	+4.7-Vdc (floating) output
SLIDER	915V-1/2 TEST PANEL	Follow-up potentiometer slider position test point
+24.7 VDC	915V-1/2 TEST PANEL	+24.7-Vdc (floating) output
+30 VDC	915V-1/2 TEST PANEL	+30-Vdc (floating) output
COMMON	915V-1/2 TEST PANEL	Test set ground
SERVO INPUT	915V-1/2 TEST PANEL	Servo input voltage monitor
CRS SHAPING OUTPUT	915V-1/2 TEST PANEL	Voltage shaper output monitor
SERVO POSITION OUTPUT	915V-1/2 TEST PANEL	Servo position analog voltage monitor
SERVO AMPL OUTPUT	915V-1/2 TEST PANEL	Regulator servo amplifier output monitor
TP1	915V-1	0-Vdc (floating) test point
TP2	915V-1	+21.6-Vdc (floating) test point

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control

TEST EQUIPMENT REQUIRED:

Digital Voltmeter, Fluke 8300A
Electronic Circuit Plug-In Unit Test Set
TS-3356/TSC-60(V) (975K-2 Test Set)

PRELIMINARY INSTRUCTIONS:

1. Set 975K-2 POWER switch to OFF and set test function selector to 915V-1/2.
2. Plug the 915V-1 into 975K-2 test connector J3. Do not force the unit, but seat it firmly.
3. Set 975K-2 POWER switch to ON. On 915V-1/2 TEST PANEL, set POWER INTERLOCK switch to ON and SERVO INPUT selector to CRS MODE.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	VOLTAGE SHAPER OUTPUT TESTS (CHECKS CARD A1)			
	NOTE Two sets of standards are given. The first set is for A1 cards below CI71443. The second set (in parentheses) is for A1 cards CI71443 and above. Steps 1n. through 1q. apply only to the newer cards.			
1	a. Set FREQUENCY MHZ selector to 2 and SERVO SYSTEM selector to DRIVER.			
	b. Connect 8300A to points of test.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		1.63 to 2.83 Vdc (1.38 to 2.13 Vdc)
	c. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		1.41 to 2.24 Vdc (0.89 to 1.83 Vdc)

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	d. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		5.22 to 5.82 Vdc (5.19 to 5.74 Vdc)
	e. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		3.50 to 4.20 Vdc (3.28 to 3.95 Vdc)
	f. Set FREQUENCY MHZ selector to 3 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		5.02 to 6.02 Vdc (4.69 to 5.54 Vdc)
	g. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		4.50 to 5.20 Vdc (4.28 to 5.25 Vdc)
	h. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		7.43 to 8.63 Vdc (8.34 to 8.91 Vdc)
	i. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		6.12 to 6.82 Vdc (6.35 to 7.08 Vdc)
	j. Set FREQUENCY MHZ selector to 5 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		8.65 to 9.65 Vdc (8.74 to 9.48 Vdc)
	k. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		9.05 to 9.80 Vdc (8.48 to 9.26 Vdc)

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	l. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		13.29 to 13.89 Vdc (13.37 to 13.94 Vdc)
	m. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		8.29 to 9.34 Vdc (8.72 to 9.76 Vdc)
	n. Set FREQUENCY MHZ selector to 8 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		(12.20 to 13.00 Vdc)
	o. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		(10.86 to 11.46 Vdc)
	p. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT		(15.21 to 16.36 Vdc)
	q. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT		(10.85 to 12.19 Vdc)
	r. Set FREQUENCY MHZ selector to 28 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT		17.80 to 18.80 Vdc (18.30 to 19.00 Vdc)
	s. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT		18.2 to 18.9 Vdc (17.90 to 18.69 Vdc)

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	t. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT		18.65 to 19.25 Vdc (18.36 to 18.92 Vdc)
	u. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT		15.50 to 16.40 Vdc (15.22 to 16.55 Vdc)
	v. Set FREQUENCY MHZ selector to 29.9 and SERVO SYSTEM selector to DRIVER	+4.7 VDC (-) and CRS SHAPING OUTPUT		18.15 to 19.15 Vdc (18.70 to 19.30 Vdc)
	w. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT		18.80 to 19.50 Vdc (19.07 to 19.63 Vdc)
	x. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS XHAPING OUTPUT (+)		18.50 to 19.20 Vdc (18.48 to 19.04 Vdc)
	y. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		15.70 to 16.75 Vdc (15.67 to 17.10 Vdc) NOTE If preceding standards were not met, perform the adjustments of paragraph 2-186.
SERVO PREAMPLIFIER OUTPUT TEST (CHECKS CARDS A2 AND A3)				
2	a. Connect the 8300A (ungrounded) to points of test.	CRS SHAPING OUTPUT (-) and SLIDER (+)		

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	b. Adjust SERVO FOLLOW UP control for 0-Vdc indication on the 8300A with SERVO SYSTEM selector in DRIVER.			
	c. Connect the 8300A to points of test.	COMMON (-) and SERVO AMPL OUTPUT (+)		0 ±0.04 Vdc
	d. Set SERVO ERROR switch to ON.	SERVO ERROR		
		BIT 1		On
		BIT 2		On
		SERVO RUN		Off
	e. Set SERVO ERROR switch to OFF.			
	f. Repeat steps b. through e. with SERVO SYSTEM selector in PRIMARY, SECONDARY, and LOADING.			Same as steps c. and d.
	g. Set SERVO ERROR switch to ON. Set SERVO SYSTEM switch to DRIVER. Adjust SERVO FOLLOW UP control so BIT 1 is on, BIT 2 lamp just goes out, and SERVO RUN lamp just comes on.			

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	h. Connect the 8300A to points of test.	COMMON (-) and SERVO AMPL OUTPUT (+)		+0.050 ±0.010 Vdc
	i. Repeat steps g. and h. with SERVO SYSTEM selector in PRIMARY, SECONDARY, and LOADING.			Same as step h.
	j. Repeat steps g., h., and i. with SERVO FOLLOW UP control adjusted so BIT 1 lamp just goes out, BIT 2 lamp is on, and SERVO RUN lamp just comes on.	COMMON (-) and SERVO AMPL OUTPUT (+)		-0.050 ±0.010 Vdc
VOLTAGE REGULATOR SERVO AMPLIFIER TEST (CHECKS CARDS A6 AND A7)				
3	a. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to REG AMPL.			
	b. Connect the 8300A to points of test and adjust INPUT control for 0-Vdc reading on 8300A.	AMPL/ OVERLOAD INPUT (+) AMPL/ OVERLOAD COM (-)		
	c. Connect the 8300A to points of test.	AMPL/ OVERLOAD OUTPUT (+)		+5 ±0.1 Vdc

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3 (Cont)		AMPL/ OVER-LOAD COM (-)		
	d. Momentarily set INTERLOCK POWER switch to OFF.	AMPL/ OVER-LOAD OUTPUT (+)		0 ±0.8 Vdc (logic 0)
		AMPL/ OVER-LOAD COM (-)		
	e. Connect the 8300A to points of test and adjust INPUT control for +100-mV reading on the 8300A.	AMPL/ OVER-LOAD INPUT (+)		
		AMPL/ OVER-LOAD COM (-)		
	f. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to REG SERVO.			
	g. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+)		+27 to +29 Vdc
		AMPL/ OVER-LOAD COM (-)		
	h. Connect the 8300A to points of test and adjust INPUT control for -100-mV reading on the 8300A.	AMPL/ OVER-LOAD INPUT (+)		
		AMPL/ OVER-LOAD COM (−)		

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3 (Cont)	i. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) AMPL/ OVER-LOAD COM (-)		+27 to +29 Vdc
SERVO TEST [CHECKS CARDS A2 (IN PRIMARY AND SECONDARY) AND A3 (IN DRIVER AND LOADING)]				
4	a. Set SERVO INPUT selector to FINE DISC and SERVO SYSTEM selector to DRIVER.			
	b. Connect the 8300A to points of test and adjust SERVO INPUT control for +2 Vdc.	SERVO INPUT (+) and COMMON (-)		
	c. Connect the 8300A to points of test.	SERVO AMPL OUTPUT (+) and COMMON (-)		+240 to +450 mVdc
	d. Set SERVO INPUT selector to TACH +.	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	e. Set SERVO INPUT selector to TACH -.	SERVO AMPL OUTPUT (+) and COMMON (-)		-1 ±0.2 Vdc
	f. Set SERVO INPUT selector to FINE DISC and SERVO SYSTEM selector to SECONDARY and readjust per step b.	SERVO AMPL OUTPUT (+) and COMMON (-)		+30 to +150 mVdc
	g. Set SERVO INPUT selector to TACH +.	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc
	h. Set SERVO INPUT selector to TACH -.	SERVO AMPL OUTPUT (+) and COMMON (-)		-1 ±0.2 Vdc
	i. Set SERVO SYSTEM selector to DRIVER and SERVO INPUT selector to FINE DISC.			
	j. Connect the 8300A to points of test and adjust SERVO INPUT control for -2 Vdc.	SERVO INPUT (-) and COMMON (+)		
	k. Connect the 8300A to points of test.	SERVO AMPL OUTPUT (-) and COMMON (+)		-240 to -450 mVdc

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	l. Set SERVO SYSTEM selector to SECONDARY and readjust per step j.	SERVO AMPL OUTPUT (-) and COMMON (+)		-30 to -150 mVdc
	m. Set SERVO SYSTEM selector to PRIMARY.			
	n. Connect the 8300A to points of test and adjust SERVO INPUT control for +1.5 Vdc.	SERVO INPUT (+) and COMMON (-)		NOTE Values in parentheses in steps o., p., and q. apply if card A1 has CI71373 or higher.
	o. Connect the 8300A to points of test.	SERVO AMPL OUTPUT (+) and COMMON (-)		+0.15 to +0.35 Vdc (+0.09 to +0.18 Vdc)
	p. Set SERVO INPUT selector to TACH +.	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc (+1 ±0.5 Vdc)
	q. Set SERVO INPUT selector to TACH -.	SERVO AMPL OUTPUT (+) and COMMON (-)		-1 ±0.2 Vdc (-1 ±0.5 Vdc)
	r. Set SERVO INPUT selector to FINE DISC and SERVO SYSTEM selector to LOADING and readjust per step n.	SERVO AMPL OUTPUT (+) and COMMON (-)		+2.1 to 3.0 Vdc

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	s. Set SERVO INPUT selector to TACH +.	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc
	t. Set SERVO INPUT selector to TACH -.	SERVO AMPL OUTPUT (+) and COMMON (-)		-1 ±0.2 Vdc
	u. Set SERVO INPUT selector to FINE DISC and SERVO SYSTEM selector to PRIMARY.			
	v. Connect the 8300A to points of test and adjust SERVO INPUT control for -1.5 Vdc.	SERVO INPUT (+) and COMMON (-)		NOTE Values in parentheses in step w. apply if card A1 has CI71373 or higher.
	w. Connect the 8300A to points of test.	SERVO AMP OUTPUT (+) and COMMON (-)		-0.15 to -0.35 Vdc (-0.09 to -0.18 Vdc)
	x. Set SERVO SYSTEM selector to LOADING and readjust per step v.	SERVO AMPL OUTPUT (+) and COMMON (-)		-2.1 to -3.0 Vdc

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	OVERLOAD AND METERING CIRCUITS TESTS (CHECKS CARD A5)			
5	a. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to CUR AMPL 1.			
	b. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -0.15 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	c. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		+0.14 to +0.16 Vdc
	d. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to CUR OVLD 1.			
	e. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -3.5 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	f. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		+2.5 to +5 Vdc (logic 1)
	g. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -2.9 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	h. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COMM (-)		0 ±0.8 Vdc (logic 0)
	i. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to CUR AMPL 2.			
	j. Connect the 8300A to points of test and adjust AMPLIFIER/OVER-LOAD CIRCUIT TEST INPUT control for +0.15 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	k. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		+1.4 to +1.6 Vdc.
	l. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to CUR OVLD 2.			
	m. Connect the 8300A to points of test and adjust AMPLIFIER/OVER-LOAD CIRCUIT TEST INPUT control for +0.2 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	n. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) AND COM (-)		+2.5 to +5 Vdc (logic 1)

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	GAIN CONTROL CIRCUIT TEST (CHECKS CARD A5)			
6	a. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to ADL AMP.			
	b. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT INPUT control for +1.0 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	c. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +10 Vdc
	d. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to IGC AMPL 1.			
	e. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -11 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	f. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +3 Vdc
	g. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -8 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	h. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		No more than +0.05 Vdc
	i. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to IGC AMPL 2.			
	j. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -1.2 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	k. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +3 Vdc
	l. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to IGC AMPL 3.			
	m. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -1.2 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	n. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +3 Vdc

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	o. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for 0 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	p. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		No more than +0.05 Vdc
	q. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to IGC AMPL 4.			
	r. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for +3.5 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	s. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		No more negative than -1.0 Vdc
	t. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to TUNE CONT.			
	u. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for +3.0 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		

Table 2-52. Performance Test Standards for 915V-1 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	v. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		0 ±0.8 Vdc (logic 0)
	w. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for 0 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	x. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +3 Vdc

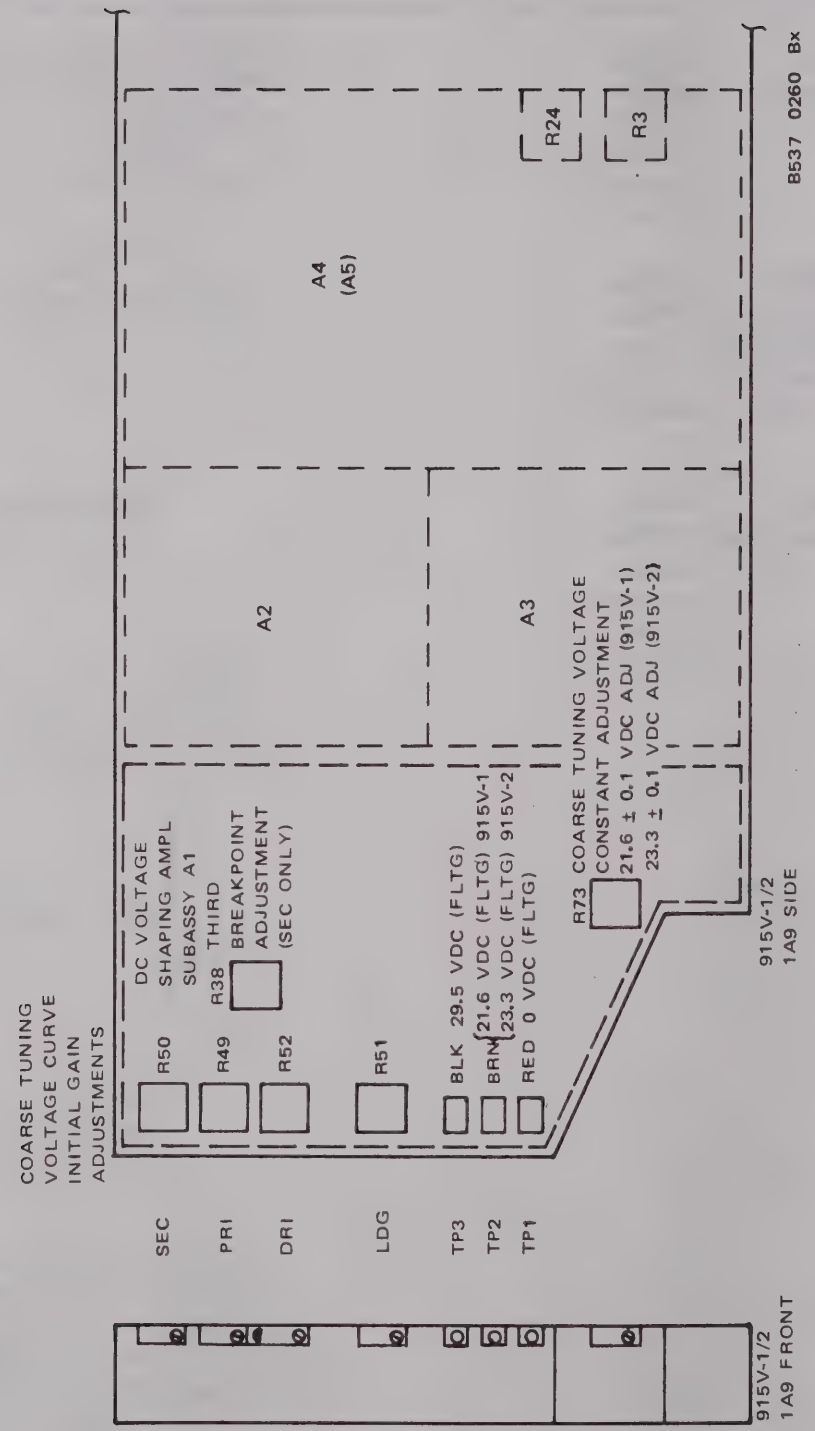

Figure 2-37. Location of 915V-1/2 Adjustment Points

Table 2-53. Voltage Shaper Limits for 915V-1 Amplifier Control

SERVO SYSTEM	ADJUSTMENT	OUTPUT (VDC) AT 2 MHz	OUTPUT (VDC) AT 28 MHz
DRIVER	A1R52	1.63 — 2.83 (1.38 — 2.13)	17.80 — 18.80 (18.30 — 19.00)
PRIMARY	A1R49	1.41 — 2.24 (0.89 — 1.83)	18.20 — 18.90 (17.90 — 18.69)
SECONDARY	A1R50	5.22 — 5.82 (5.19 — 5.74)	18.65 — 19.25 (18.36 — 18.92)
LOADING	A1R51	3.50 — 4.20 (3.28 — 3.95)	15.50 — 16.40 (15.22 — 16.55)

2-190. AMPLIFIER CONTROL C-8366/TSC-60(V) (915V-2 AMPLIFIER CONTROL).

2-191. The following paragraphs provide instructions for special maintenance of Amplifier Control C-8366/TSC-60(V) (915V-2 Amplifier Control). All maintenance instructions are preformed while the 915V-2 is connected to the 975K-2 test set. Testing is to a level necessary for fault isolation to an assembly.

2-192. TEST POINTS. Table 2-54 lists the functions of the test points listed for adjustments and in the performance test standards table.

2-193. PERFORMANCE TESTS. Table 2-55 lists the procedures for performance testing the 915V-2. Perform all steps in the order listed. Continue through the numbered steps until a malfunction is discovered or until the test is completed. If the unit fails to meet a performance standard, use standard troubleshooting procedures to isolate the faulty assembly. After any repair, perform the entire performance test.

2-194. ADJUSTMENT PROCEDURES. The following paragraphs provide adjustment for the 915V-2. Figure 2-37 shows locations of adjustments.

2-195. Preliminary Procedures.

a. Remove 915V-2 dust cover.

b. Turn off power to 975K-2 and set test function selector to 915V-1/2.

c. Set 915V-1/2 TEST PANEL controls as follows:

SERVO SYSTEM — DRIVER

SERVO INPUT — CRS MODE

PWR INTERLOCK — ON

FREQUENCY MHZ — 2

d. Connect 915V-2 to 975K-2 test connector J3 and set 975K-2 POWER switch to ON.

2-196. Voltage Shaper Adjustments.

NOTE

The voltage adjustment in the following step is a reference voltage only. It may be necessary to re-adjust A1R73 higher or lower than 23.3 Vdc in order to meet performance standards at all frequencies in table 2-55.

a. Connect the 8300A digital voltmeter to TP1 (-) and TP2 (+) (figure 2-37). Adjust A1R73 for +23.3 ±0.02 Vdc (8300A must be ungrounded).

b. Connect the 8300A negative (-) to +4.7 VDC test jack on 975K-2 and the 8300A positive (+) to CRS SHAPING OUTPUT jack.

c. Adjust potentiometer A1R52 to obtain voltage listed in table 2-56.

NOTE

Voltage values of table 2-56 in parentheses are for A1 cards CI71443 and above; other voltages listed are for A1 cards below CI71443.

d. Set 975K-2 SERVO SYSTEM selector to PRIMARY and adjust potentiometer A1R49 to obtain voltage listed in table 2-56.

e. Set 975K-2 SERVO SYSTEM selector to SECONDARY and adjust potentiometer A1R50 to obtain voltage listed in table 2-56.

f. Set 975K-2 SERVO SYSTEM selector to LOADING and adjust potentiometer A1R51 to obtain voltage listed in table 2-56.

g. Set FREQUENCY MHZ selector to 28 with SERVO SYSTEM selector in SECONDARY. Adjust A1R38 to obtain 18.41 to 19.41 (18.52 to 18.62) Vdc.

h. Set FREQUENCY MHZ selector to 28. Connect the 8300A as in step b. and operate SERVO SYSTEM selector to each of the four positions. In each position, verify that voltage limits of table 2-56 are met (make no adjustments).

i. If limits of step i. are not met, repeat the entire procedure and adjust voltages toward upper or lower limits to allow all requirements to be met.

2-197. Metering Amplifier Adjustments.

CAUTION

In the procedure that follows, it is necessary to remove cards A6 and A7 from the 915V-2 sideboard in order to adjust potentiometers A5R3 and A5R24. Remove power from the 915V-2 before removing or replacing these cards.

a. Remove power from the 915V-2 and remove cards A6 and A7 from the sideboard.

b. Set 975K-2 AMPLIFIER/OVERLOAD CIRCUIT TEST selector to CUR AMPL 1 and set POWER switch to ON.

c. Connect the 8300A digital voltmeter to AMPL/OVERLOAD INPUT jack (+) and AMPL/OVERLOAD COM (-).

d. Adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control to obtain -0.15 Vdc.

e. Connect the 8300A to AMPL/OVERLOAD OUTPUT (+) and AMPL/OVERLOAD COM (-).

f. Adjust potentiometer A5R3 (nearest the lower connector) to obtain +0.15 ±0.005 Vdc.

g. Set 975K-2 AMPLIFIER/OVERLOAD CIRCUIT TEST selector to CUR AMPL 2.

h. Adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control for +0.15 Vdc at AMPL/OVERLOAD INPUT jack (+) and COM (-).

i. Adjust potentiometer A5R24 (upper of the two potentiometers) to obtain +1.5 ±0.01 Vdc at AMPL/OVERLOAD OUTPUT jack (+) and COM (-).

j. Remove power from 915V-2 and replace cards A6 and A7.

k. Repeat performance test of table 2-55.

Table 2-54. 915V-2 Test Points

TEST POINT	LOCATION	CIRCUIT FUNCTION
AMPL/OVERLOAD INPUT	915V-1/2 TEST PANEL	Amplifier and sensor input voltage monitor
AMPL/OVERLOAD OUTPUT	915V-1/2 TEST PANEL	Amplifier and sensor output voltage monitor
AMPL/OVERLOAD COM	915V-1/2 TEST PANEL	Amplifier and sensor test common
0 VDC	915V-1/2 TEST PANEL	0-Vdc (floating) output
+4.7 VDC	915V-1/2 TEST PANEL	+4.7-Vdc (floating) output
SLIDER	915V-1/2 TEST PANEL	Followup potentiometer slider position test point
+24.7 VDC	915V-1/2 TEST PANEL	+24.7-Vdc (floating) output
+30 VDC	915V-1/2 TEST PANEL	+30-Vdc (floating) output
COMMON	915V-1/2 TEST PANEL	Test set ground
SERVO INPUT	915V-1/2 TEST PANEL	Servo input voltage monitor
CRS SHAPING OUTPUT	915V-1/2 TEST PANEL	Voltage shaper output monitor
SERVO POSITION OUTPUT	915V-1/2 TEST PANEL	Servo position analog voltage monitor
SERVO AMPL OUTPUT	915V-1/2 TEST PANEL	Regulator servo amplifier output monitor
TP1	915V-2	0-Vdc (floating) test point
TP2	915V-2	+23.3-Vdc (floating) test point

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control

TEST EQUIPMENT REQUIRED:

Digital Voltmeter, Fluke 8300A
Electronic Circuit Plug-In Unit Test Set TS-3356/TSC-60(V) (975K-2 Test Set)

PRELIMINARY INSTRUCTIONS:

1. Set 975K-2 POWER switch to OFF and set test function selector to 915V-1/2.
2. Plug 915V-2 into 975K-2 test connector J3. Do not force the unit, but seat it firmly.
3. Set 975K-2 POWER switch to ON. On 915V-1/2 TEST PANEL, set POWER INTERLOCK switch to ON and SERVO INPUT selector to CRS MODE.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	VOLTAGE SHAPER OUTPUT TEST (CHECKS CARD A1)			
	NOTE Two sets of standards are given. The first set is for A1 cards below CI71443. The second set (in parentheses) is for A1 cards CI71443 and above.			
1	a. Set FREQUENCY MHZ selector to 2 and SERVO SYSTEM selector to DRIVER.			
	b. Connect the 8300A to points of test	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		1.84 to 2.56 Vdc (1.86 to 1.96 Vdc)
	c. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		0.61 to 1.41 Vdc (0.54 to 0.64 Vdc)
	d. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		2.71 to 3.71 Vdc (3.32 to 3.42 Vdc)

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	e. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		3.91 to 5.91 Vdc (4.29 to 4.39 Vdc)
	f. Set FREQUENCY MHZ selector to 3 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		4.81 to 5.81 Vdc (5.00 to 5.50 Vdc)
	g. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		2.91 to 4.11 Vdc (3.64 to 4.26 Vdc)
	h. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		6.31 to 6.91 Vdc (6.80 to 7.36 Vdc)
	i. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		6.81 to 8.81 Vdc (6.75 to 7.75 Vdc)
	j. Set FREQUENCY MHZ selector to 5 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		8.31 to 9.31 Vdc) (8.50 to 9.45 Vdc)
	k. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		6.81 to 8.81 Vdc (8.18 to 8.82 Vdc)
	l. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		11.41 to 12.41 Vdc (11.70 to 12.50 Vdc)

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	m. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		10.11 to 12.11 Vdc (10.78 to 11.68 Vdc)
	n. Set FREQUENCY MHZ selector to 8 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		11.61 to 12.61 Vdc (11.70 to 12.65 Vdc)
	o. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		10.31 to 11.31 Vdc (11.17 to 11.80 Vdc)
	p. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		14.31 to 15.31 Vdc (14.74 to 15.40 Vdc)
	q. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		11.81 to 13.81 Vdc (12.10 to 13.33 Vdc)
	r. Set FREQUENCY MHZ selector to 28 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		17.61 to 18.41 Vdc (18.00 to 18.85 Vdc)
	s. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		17.81 to 18.41 Vdc (18.13 to 18.78 Vdc)
	t. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		18.41 to 19.41 Vdc (18.52 to 18.62 Vdc)

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	u. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		16.11 to 18.11 Vdc (15.89 to 16.83 Vdc)
	v. Set FREQUENCY MHZ selector to 29.9 and SERVO SYSTEM selector to DRIVER.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		18.07 to 18.81 Vdc (18.30 to 19.20 Vdc)
	w. Set SERVO SYSTEM selector to PRIMARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		18.48 to 19.15 Vdc (18.74 to 19.40 Vdc)
	x. Set SERVO SYSTEM selector to SECONDARY.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		18.12 to 18.58 Vdc (18.32 to 18.88 Vdc)
	y. Set SERVO SYSTEM selector to LOADING.	+4.7 VDC (-) and CRS SHAPING OUTPUT (+)		16.28 to 18.22 Vdc (15.93 to 17.27 Vdc)
	NOTE If preceding standards were not met, perform the adjustments of paragraph 2-194.			
	SERVO PREAMPLIFIER OUTPUT TEST (CHECKS CARDS A2 AND A3)			
2	a. Connect the 8300A (ungrounded) to points to test. b. Adjust SERVO FOLLOW UP control for 0-Vdc indication on the 8300A with SERVO SYSTEM selector in DRIVER.	CRS SHAPING OUTPUT (-) and SLIDER (+)		

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	c. Connect the 8300A to points of test.	COMMON (-) and SERVO AMPL OUTPUT (+)		0 ±0.04 Vdc
	d. Set SERVO ERROR switch to ON.	SERVO ERROR BIT 1 BIT 2 SERVO RUN		 On On Off
	e. Set SERVO ERROR switch to OFF.			
	f. Repeat steps b. through e. with SERVO SYSTEM selector in PRIMARY, SECONDARY, and LOADING.			Same as steps c. and d.
	g. Set SERVO ERROR switch to ON. Set SERVO SYSTEM switch to DRIVER. Adjust SERVO FOLLOW UP control so BIT 2 just goes out and SERVO RUN just comes on.			
	h. Connect the 8300A to points of test.	COMMON (-) and SERVO AMPL OUTPUT (+)		+0.050 ±0.010 Vdc

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	i. Repeat steps g. and h. with SERVO SYSTEM selector in PRIMARY, SECONDARY, and LOADING.			Same as step h.
	j. Repeat steps g., h., and i. with SERVO FOLLOW UP control adjusted so BIT 1 lamp just goes out, BIT 2 lamp is on, and SERVO RUN lamp just comes on.	COMMON (-) and SERVO AMPL OUTPUT (+)		-0.050 ±0.010 Vdc
	VOLTAGE REGULATOR SERVO AMPLIFIER TEST (CHECKS CARDS A6 AND A7)			
3	a. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to REG AMPL.			
	b. Connect the 8300A to points of test and adjust INPUT control for 0-Vdc reading on the 8300A.	AMPL/ OVERLOAD INPUT (+) AMPL/ OVERLOAD COM (-)		
	c. Connect the 8300A to points of test.	AMPL/ OVERLOAD OUTPUT (+) AMPL/ OVERLOAD COM (-)		+5 ±0.1 Vdc

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3 (Cont)	d. Momentarily set INTERLOCK POWER switch to OFF.	AMPL/ OVER-LOAD OUTPUT (+) AMPL/ OVER-LOAD COM (-)		0 ±0.8 Vdc (logic 0)
	e. Connect the 8300A to points of test and adjust INPUT control for +100-mV reading the 8300A.	AMPL/ OVER-LOAD INPUT (+) AMPL/ OVER-LOAD COM (-)		
	f. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to REG SERVO.			
	g. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) AMPL/ OVER-LOAD COM (-)		+27 to +29 Vdc
	h. Connect the 8300A to points of test and adjust INPUT control for -100-mV reading on the 8300A.	AMPL/ OVER-LOAD INPUT (-) AMPL/ OVER-LOAD COM (+)		

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
3 (Cont)	i. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) AMPL/ OVER-LOAD COM (-)		+27 to +29 Vdc
	SERVO TEST [CHECKS CARDS A2 (IN PRIMARY AND SECONDARY) AND A3 (IN DRIVER AND LOADING)]			
4	a. Set SERVO INPUT selector to FINE DISC and SERVO SYSTEM selector to DRIVER.			
	b. Connect the 8300A to points of test and adjust SERVO INPUT control for +2 Vdc.	SERVO INPUT (+) and COMMON (-)		
	c. Connect the 8300A to points of test.	SERVO AMPL OUTPUT (+) and COMMON (-)		+195 to +350 mVdc
	d. Set SERVO INPUT selector to TACH +.	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc
	e. Set SERVO INPUT selector to TACH -.	SERVO AMPL OUTPUT (+) and COMMON (-)		-1 ±0.2 Vdc

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	f. Set SERVO INPUT selector to FINE DISC and SERVO SYSTEM selector to SECONDARY and readjust per step b.	SERVO AMPL OUTPUT (+) and COMMON (-)		+100 to +200 mVdc
	g. Set SERVO INPUT selector to TACH +.	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc
	h. Set SERVO INPUT selector to TACH	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc
	i. Set SERVO SYSTEM selector to DRIVER and SERVO INPUT selector to FINE DISC.			
	j. Connect the 8300A to points of test and adjust SERVO INPUT control for -2 Vdc.	SERVO AMPL INPUT (+) and COMMON (-)		
	k. Connect the 8300A to points of test.	SERVO AMPL OUTPUT (+) and COMMON (-)		-195 to -350 mVdc
	l. Set SERVO SYSTEM selector to SECONDARY and readjust per step j.	SERVO AMPL OUTPUT (-) and COMMON (+)		-100 to -200 mVdc

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	m. Set SERVO SYSTEM selector to PRIMARY.			
	n. Connect the 8300A to points of test and adjust SERVO INPUT control for +1.5 Vdc.	SERVO INPUT (+) and COMMON (-)		
	o. Connect the 8300A to points of test.	SERVO AMPL OUTPUT (+) and COMMON (-)		+0.75 to +1.25 Vdc
	p. Set SERVO INPUT selector to TACH +.	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc
	q. Set SERVO INPUT selector to TACH -.	SERVO AMPL OUTPUT (+) and COMMON (-)		-1 ±0.2 Vdc
	r. Set FREQUENCY MHz selector to 15 MHz. Set SERVO INPUT selector to FINE DISC and SERVO SYSTEM selector to LOADING; readjust per step n.	SERVO AMPL OUTPUT (+) and COMMON (-)		+2.0 to 3.2 Vdc
	s. Set SERVO INPUT selector to TACH +.	SERVO AMPL OUTPUT (+) and COMMON (-)		+1 ±0.2 Vdc

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
4 (Cont)	t. Set SERVO INPUT selector to TACH	SERVO AMPL OUTPUT (+) and COMMON (-)		-1 ±0.2 Vdc
	u. Set SERVO INPUT selector to FINE DISC and SERVO SYSTEM selector to PRIMARY.			
	v. Connect the 8300A to points of test and adjust SERVO INPUT control for -1.5 Vdc.	SERVO AMPL INPUT (+) and COMMON (-)		
	w. Connect the 8300A to points of test.	SERVO AMPL OUTPUT (+) and COMMON (-)		-0.75 to -1.25 Vdc
	x. Set SERVO SYSTEM selector to LOADING and readjust per step v.	SERVO AMPL OUTPUT (+) and COMMON (-)		-2.0 to -3.2 Vdc
	OVERLOAD AND METERING CIRCUIT TESTS (CHECKS CARD A5)			
5	a. Set AMPLIFIER/OVERLOAD CIRCUIT TEST selector to CUR AMPL 1.			
	b. Connect the 8300A to points of test and adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control for -0.15 Vdc.	AMPL/OVERLOAD INPUT (+) and COM (-)		

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	c. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		+0.14 to +0.16 Vdc
	d. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to CUR OVLD 1.			
	e. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -3.5 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	f. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		+2.5 to +5 Vdc (logic 1)
	g. Connect the 8300A to points of test and adjust AMPLIFIER/ CIRCUIT TEST INPUT control for -2.9 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	h. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		0 ±0.8 Vdc (logic 0)
	i. Set AMPLIFIER/ OVER LOAD CIRCUIT TEST selector to CUR AMPL 2.			

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	j. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for +0.15 Vdc.	AMPL/ OVER-LOAD IN-PUT (+) and COM (-)		
	k. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		+1.4 to +1.6 Vdc
	l. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to CUR OVLD 2.			
	m. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for +0.2 Vdc.	AMPL/ OVER-LOAD IN-PUT (+) and COM (-)		
	n. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		+2.5 to +5 Vdc (logic 1)
	o. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT INPUT control for +0.15 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	p. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		0 ±0.8 Vdc (logic 0)

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	q. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to VSWR OVLD.			
	r. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for +3.15 Vdc.	AMPL/ OVER-LOAD IN-PUT (+) and COM (-)		
	s. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		+2.5 to +5 Vdc (logic 1)
	t. Connect the 8300A to points of test and adjust AMPLI-FIER/OVERLOAD CIRCUIT TEST INPUT control for +2.85 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	u. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		0 ±0.8 Vdc (logic 0)
	v. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to RF IN SENSOR.			
	w. Connect the 8300A to points of test and adjust AMPLI-FIER/OVERLOAD CIRCUIT TEST INPUT for +0.06 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
5 (Cont)	x. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		0 ±0.8 Vdc (logic 0)
	y. Connect the 8300A to points of test and adjust AMPLI-FIER/OVERLOAD CIRCUIT TEST INPUT control for +0.04 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	z. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COMM (-)		+2.5 to +5 Vdc (logic 1)
GAIN CONTROL CIRCUIT TEST (CHECKS CARD A5)				
6	a. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to ADL AMPL.			
	b. Connect the 8300A to points of test and adjust AMPLI-FIER/OVERLOAD CIRCUIT TEST INPUT control for +1.0 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	c. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +10 Vdc
	d. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to IGC AMPL 1.			

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	e. Connect the 8300A to points of test and adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control for -11 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	f. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +3 Vdc
	g. Connect the 8300A to points of test and adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control for -8 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	h. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		No more than +0.05 Vdc
	i. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to IGC AMPL 2.			
	j. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for -1.2 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	k. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +3 Vdc

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	l. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to IGC AMPL 3.			
	m. Connect the 8300A to points of test and adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control for -1.2 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	n. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +3.0 Vdc
	o. Connect the 8300A to points of test and adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control for 0 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	p. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		No more than +0.05 Vdc
	q. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to IGC AMPL 4.			
	r. Connect the 8300A to points of test and adjust AMPLIFIER/OVERLOAD CIRCUIT TEST INPUT control for +3.5 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		

Table 2-55. Performance Test Standard for 915V-2 Amplifier Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
6 (Cont)	s. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		No more negative than -1 Vdc.
	t. Set AMPLIFIER/ OVERLOAD CIRCUIT TEST selector to TUNE CONT.			
	u. Connect the 8300A to points of test and adjust AMPLIFIER/ OVERLOAD CIRCUIT TEST INPUT control for +3.0 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	v. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		0 ±0.8 Vdc out
	w. Connect the 8300A to points of test and adjust AMPLI-FIER/OVERLOAD CIRCUIT TEST INPUT control for 0 Vdc.	AMPL/ OVER-LOAD INPUT (+) and COM (-)		
	x. Connect the 8300A to points of test.	AMPL/ OVER-LOAD OUTPUT (+) and COM (-)		Not less than +3 Vdc

Table 2-56. Voltage Shaper Limits for 915V-2 Amplifier Control

SYSTEM	ADJUSTMENT	OUTPUT (VDC) AT 2 MHz	OUTPUT (VDC) AT 28 MHz
DRIVER	A1R52	1.84 — 2.56 (1.86 to 1.96)	17.61 — 18.41 (18.00 to 18.85)
PRIMARY	A1R49	0.61 — 1.41 (0.54 to 0.64)	17.81 — 18.41 (18.13 to 18.78)
SECONDARY	A1R50	2.71 — 3.71 (3.32 to 3.42)	18.41 — 19.41 (18.52 to 18.62)
LOADING	A1R51	3.91 — 5.91 (4.29 to 4.39)	16.11 — 18.11 (15.89 to 16.83)

2-198. CONTROL-MONITOR C-8376/TSC-60(V) (915X-1).

2-199. The following paragraphs provide instructions for special maintenance of Control-Monitor C-8376/TSC-60(V) (915X-1 Control-Monitor). All maintenance instructions are performed while the 915X-1 is connected to the 975K-2 test set. Testing is to a level necessary for fault isolation to an assembly.

2-200. TEST POINTS. Table 2-57 lists the functions of the test points listed for adjustments and in the performance test standards table. The test points listed are located on the 975K-2 test set or on the 915X-1 circuit card connectors.

2-201. PERFORMANCE TESTS. Table 2-58 lists the procedures for performance testing the 915X-1. Perform all steps in the order listed. Continue through the numbered steps until a malfunction is discovered or until the test is completed. If the unit fails to meet a performance standard, use standard troubleshooting procedures to isolate the faulty assembly. After any repair, perform the entire performance test.

2-202. ADJUSTMENT PROCEDURES. The following paragraphs provide adjustment procedures for the 915X-1. Figures 2-30 and 2-31 show the locations of adjustments.

2-203. Preliminary Procedures.

a. Remove dust cover and air deflector from 915X-1.

b. Turn off power to 975K-2 and set test function selector to 915X-1.

c. Connect 915X-1 to extender cable CX-12775/TSC-60(V) and connect extender cable to test connector J4 of 975K-2.

d. Use the CX-12776/TSC-60(V) test lead to connect LCU SINE WAVE connector of 7404A-1 to the CONTROL, CLOCK, and MONITOR jacks of the 915X-1/2 TEST PANEL.

e. Set 915X-1/2 TEST PANEL controls as follows:

DCU ADDRESS (1 through 5) — 10101

UNIT INTLK — NORM

FIL TIME DELAY — 0

DIGITAL MONITOR STATUS — 1

A/D INPUT — 0 VDC

f. Set 975K-2 POWER switch to ON.

g. Set 7404A-1 controls as follows:

DCFE/DCU-LCU-
LCU/DCU — LCU (rear panel)

PARITY ENCODE — MANUAL

PARITY MODE — SENSED

RETRANSMIT — CONTINUAL

ADDRESS LENGTH — 5 BIT

MODE — HDX

SINE WAVE/LOGIC
LEVEL — SINE WAVE (rear panel)

Bits 0 through 7 — 11010110

Bits 11 through 15 — 11001

Bit 29 — 0

POWER — ON

Press SEND/READY switch twice.

2-204. Adjustments.

a. Adjust A4R1 to midrange (12.5 turns from maximum clockwise position).

NOTE

Resistor A4R2 is not used in AN/TSC-60.

b. Short A4P2-30 and A4P2-31 together.

c. Connect the 8300A digital voltmeter to A4P1-31 and A4P2-35 (card ground), and adjust A4R30 until the 8300A indicates 0 ±0.0001 Vdc.

d. Remove short from A4P2-30 and A4P2-31.

e. Apply logic 1 to A4P2-19 (jumper to A4P1-17).

f. Set A/D INPUT switch on 915X-1/2 test panel to 0.75 VDC. Connect the HP-6104A power supply (set to +1.0000 Vdc) to A4P2-30(+) and A4P2-31(-).

g. Voltage at A4P1-31 (on the 8300A) is -5 ±0.25 Vdc. Record exact indication.

h. Remove logic 1 jumper form A4P2-19 and jumper it to logic 0 (A4P2-33).

i. Set the HP-6104A to 10.0000 Vdc.

j. Adjust A4R1 for an indication on the 8300A within 0.0001 Vdc of indication in step g.

k. Remove the HP-6101A from A4P2-30 and A4P2-31 and short these pins together.

l. The 8300A indication should be 0 ±0.200 Vdc. If the 8300A shows other indication, repeat procedure starting at step h.

m. Disconnect the 8300A and connect the 454 oscilloscope to A2P1-34.

n. Set 7404A-1 bit switches 0 through 7 to 11010110 and switches 8 through 31 to 0. Set 7404A-1 RETRANSMIT switch to CONTINUAL.

o. Remove logic 0 jumper from A4P2-19 and connect a logic 1 jumper. (See step e.)

p. Adjust A2R8 so that no ramp output is visible on the 454.

q. Adjust A2R27 so that 7404A-1 lamp 14 is flickering (A/D sign threshold). When adjustment has been properly made, 7404A-1 lamps 16 through 27 will be out also.

r. Remove short from A4P2-30 and A4P2-31.

s. Connect the HP-6104A (set to +0.9995 ±0.0001 Vdc) to A4P2-30 (+) and A4P2-31 (-).

t. Adjust A2R15 so the 7404A-1 flickers between indication of 1.0 volt and 0.999 volt (lamps 16 and 18 on for 1.0 volt, and lamps 16, 19, 20, 23, 24, and 27 on for 0.999 volt).

u. Change the HP-6104A connections to supply -0.9995 ±0.0001 Vdc to A4P2-30 (-) and A4P2-31 (gnd).

v. Repeat step t. adjusting A2R20.

Table 2-57. 915X-1 Test Points

TEST POINT	LOCATION	CIRCUIT FUNCTION
COMMON	975K-2 Test Set	Circuit ground
DATA	975K-2 Test Set	Serial data test
CLOCK	975K-2 Test Set	Oscilloscope synchronization
TUNE START	975K-2 Test Set	Oscilloscope synchronization
SERVO ENABLE	975K-2 Test Set	Pulse monitor
A/D	975K-2 Test Set	Voltage monitor
A4P2-30	Circuit card connector	Analog input +
A4P2-31	Circuit card connector	Analog input -
A4P2-35	Circuit card connector	Ground no. 1
A4P1-31	Circuit card connector	Amplifier output
A4P2-19	Circuit card connector	A/D range switch
A4P1-17	Circuit card connector	Logic 1
A4P2-33	Circuit card connector	Logic 0

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control

TEST EQUIPMENT REQUIRED:

Test Lead CX-12777/TSC-60(V) (7404A-1 Test Lead)
Signal Data Indicator-Simulator SM-637/G (7404A-1 Source Generator Display Unit)
Oscilloscope, Tektronix 454
Digital Voltmeter, Fluke 8300A
Power Supply, HP-6104A or equivalent
Electronic Circuit Plug-In Unit Test Set TS-3356/TSC-60(V) (975K-2 Test Set)

CAUTION

Do not connect or disconnect 915X-1 unless power has been removed from 975K-2.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
	DIGITAL MONITOR/CONTROL TEST			
1	a. Set 975K-2 POWER switch to OFF and test function selector to 915X-1. b. Use CX-12777/TSC-60(V) test lead to connect LCU SINE WAVE connector of 7404A-1 to the CONTROL, CLOCK, and MONITOR jacks of the 915X-1/2 TEST PANEL. c. Set 915X-1/2 TEST PANEL controls as follows: Control — Position DCU ADDRESS 1 — 1 2 — 0 3 — 1 4 — 0 5 — 1 UNIT INTLK FIL TIME DELAY — NORM 0 DIGITAL MONITOR STATUS — 1			

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	d. Set 7404A-1 controls as follows: Control — Position DCFE/DCU-LCU-LCU/DCU — LCU (Rear panel) PARITY ENCODE — MANUAL PARITY MODE — SENSED RETRANSMIT — OFF ADDRESS LENGTH — 5 BIT MODE — HDX SINE WAVE/LOGIC LEVEL — SINE WAVE (rear panel) Bit Control switches 0 — 1 1 — 1 2 — 0 3 — 1 4 — 0 5 — 1 6 — 0 7 — 0 e. Plug 915X-1 into test connector J4 of 975K-2. Do not force the unit, but seat it firmly.			

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	f. Set 975K-2 POWER switch to ON.			
	g. Set 7404A-1 POWER switch to ON and press the CLEAR pushbutton.			
	h. Press SEND/ READY pushbutton twice on 7404A-1	7404A-1 monitor lamps		
		0		Off
		1		On
		2		Off
		3		On
		4		Off
		5		On
		6		Off
		7		Off
	i. Connect the 454 to points of test on 915X-1/2 TEST PANEL.	Vertical input of 454 to DATA test point. Ground lead of 454 COMMON test point.		
	j. Set 7404A-1 controls as follows:			
	Control — Position			
	RETRANSMIT — CONTINUAL			
	Bit controls			
	10 — 1			
	11-14 — 0			
	15 — 1			
	16-19 — 0			

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	Bit controls / Position 20 / 1 21-24 / 0 25 / 1 26-31 / 0			
	k. Set the 454 controls so that serial data is displayed. Set 7404A-1 bit control switches 10, 15, 20, and 25 down and up to establish data bit position	DATA		Serial data bits in same relative positions and have same values (logic 1 or logic 0) as bit control switch list of step 1j.
	l. Set various other bit switches up and down to determine that all cause a change in the display.			Same as step 1k.
	m. Set 7404A-1 bit control switches as follows: Switch / Position 6 / 0 7 / 1 8-23 / 0 24-31 / 1			
	n. Set DIGITAL MONITOR STATUS switch to 0.			
	o. On 915X-1 TEST PANEL, set CONTROL COMMAND TYPE 2 monitor select to each of its positions.	TYPE 2 lamp		On for each position.

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	p. Set 7404A-1 bit control switches as follows: Switch — Position 6 — 0 7 — 1 8-31 — 0			
	q. On 915X-1/2 TEST PANEL, operate CONTROL COMMAND TYPE 2 monitor selector to each of its positions	TYPE 2 lamp		Off for each position.
	r. Set 7404A-1 bit control switches as follows: Switch — Position 6, 7 — 1 8 — 0 9-11 — 1 12-19 — 0 20-30 — 1 31 — 0			
	s. On 915X-1/2 TEST PANEL, operate CONTROL COMMAND TYPE 4 monitor selector to each of its positions.	TYPE 4 lamp		On for each position.
	t. Set 7404A-1 bit control switches as follows:			

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	Switch — Position 6, 7 — 1 8-31 — 0			
	u. On 915X-1/2 TEST PANEL, operate CONTROL COMMAND TYPE 4 monitor selector to each of its postions.	TYPE 4 lamp		Off for each position.
	v. Set 7404A-1 bit control switches as follows: Switch — Position 6,7 — 1 8-30 — 0 31 — 1			
	w. Connect the 454 to point of test.	SERVO ENABLE		
	x. Set 7404A-1 RE-TRANSMIT switch to CONTINUAL.			
	y. Set the 454 controls for negative internal trigger and adjust as required to display negative-going pulse.	SERVO ENABLE		Bit 31 of 7404A-1 set up and down shows negative-going pulse in pulse train.
	z. Set 7404A-1 bit control switches as follows: Switch — Position 6-31 — 0			

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
1 (Cont)	aa. Set 915X-1/2 TEST PANEL DIGITAL MONITOR controls as follows. Position			On 7404A-1 lamps 13, 14, 18, 21 and 24 thru 31 are off.
	TUNE 16	7404A-1 lamp 16		On
	REFL PWR 17	7404A lamp 17		On
	PA PLATE CUR 19	7404A-1 lamp 19		On
	PA SCRN CUR 20	7404A-1 lamp 20		On
	AC/PLUG 22	7404A-1 lamp 22		On
	CKT BKR 23	7404A-1 lamp 23		On
	ab. Set DIGITAL MONITOR STATUS switch to 1 then back to 0.			On 7404A-1 the following lamps are on while DIGITAL MONITOR STATUS switch is set to 1: 13 (PA operate request) 14 (PA tune complete) 18 (Key monitor) 21 (Rf input monitor) 24 (Antenna intlk fault) 25 (Regulator monitor) 26 (Blower transfer mon) 27 (Servo error 2) 28 (Servo error 1) 29 (Counter out A) 30 (Counter out B) 31 (Counter out C)
	ac. Repeat step aa. with 7404A-1 bit switch 7 up.			Same as 1aa.
	ad. Repeat step aa. with bits 6 and 7 up.			Same as 1aa.

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
ANALOG-TO-DIGITAL CONVERTER TEST				
2	a. On 915X-1 TEST PANEL, set DIGITAL MONITOR control to TUNE and AD INPUT selector to 0 VDC. b. Set 7404A-1 bit ccontrol switch 6 to 1 and switches 7 through 31 to 0. c. Press 7404A-1 SEND/READY pushbutton twice.	7404A-1 monitor lamps 16 through 25		Off

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Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	d. On 915X-1/2 TEST PANEL, set A/D INPUT selector to +0.75 VDC.			
	e. Set 7404A-1 bit control switches 13 and 15 up. (First 1-volt range setting).			
	f. Press 7404A-1 SEND/READY push-button twice.			
	g. Connect the 8300A between points of test.	A/D (+) COMMON (-)		Record voltage measurement.
	h. Refer to table 2-59. Read 7404A-1 monitor lamp display (lamps 16-27).			Voltage reading within ±1% of measured value of step 2g.
	i. Set 7404A-1 bit control switches to the remaining 1-volt range settings (bits 12-15) shown in table 2-59. There are six more settings.			See step 2j.
	j. Press 7404A-1 SEND/READY push-button twice after each new setting.			Same as step 2h. for each new setting.
	k. Set 7404A-1 bit control switches as follows (first 10-volt range setting): Switch / Position 6 / 1 7 / 0 8-31 / 0			

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	l. On 915X-1/2 TEST PANEL, set A/D INPUT selector to +5.25 VDC. Press 7404A-1 SEND/ READY pushbutton twice.			
	m. Connect the 8300A to points of test.	A/D (+) COMMON (-)		Record voltage measurement.
	n. Refer to table 2-59. Read 7404A-1 monitor lamp display (lamps 16-27).	7404A-1 monitor lamps		Voltage reading within ±1% of measured value of step 2m.
	o. Set 7404A-1 bit control switches to the remaining 10-volt range settings shown in table 2-59. (There are eight more settings.)			See step 2p.
	p. Press the 7404A-1 SEND/READY button twice after each new setting.			Same as step 2n. for each new setting.
	q. Set 7404A-1 bits 12-15 switches down.			
	r. On 915X-1/2 TEST PANEL, set A/D INPUT control to +12.50 VDC. Press 7404A-1 SEND/ READY pushbutton twice.			
	s. Connect the 8300A between points of test.	A/D (+) COMMON (-)		Record voltage measurement.

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2 (Cont)	t. Refer to table 2-59. Read 7404A-1 monitor lamp display.	7404A-1 monitor lamp		Lamp 15 on and voltage reading within ±1% of measurement of step 2s.
	u. On 915X-1/2 TEST PANEL, set A/D INPUT control to -9.25 VDC. Press 7404A-1 SEND/ READY pushbutton twice.			
	v. Connect the 8300A between points of test.	A/D (-) COMMON (+)		Record voltage measurement.
	w. Refer to table table 2-59. Read 7404A-1 monitor lamp display.	7404A-1 monitor lamps		Lamp 15 off, lamp 14 on. Voltage reading within ±1% of measurement of step 2v.
			NOTE If steps 2a. through 2w. were abnormal, adjust per paragraph 2-202; then return to step 20.	
	x. Set 7404A-1 bit control switch 10 to1 (A/D inhibit). On 915X-1/2 TEST PANEL, set A/D INPUT control to +5.25 VDC.			
	y. Press 7404A-1 SEND/READY push-button twice.	7404A-1 monitor lamps		Same lamp display as step 2w.
	z. Set 7404A-1 bit control switches 8 through 31 to 0. On 915X-1/2 TEST PANEL, set A/D INPUT control to 0 VDC.			

Table 2-58. Performance Test Standards for 915X-1 Digital Interface Control (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARD
2	aa. On 915X-1/2 TEST PANEL, set FIL TIME DELAY switch to 1. Press 7404A-1 SEND/ READY pushbutton twice.	7404A-1 monitor lamp 12		
	ab. On 915X-1/2 TEST PANEL, set FIL TIME DELAY switch to 0, A/D INPUT control to +5.25 VDC, and UNIT INTLK switch to OFF.			
	ac. Set 7404A-1 bit control switch 12 to 1 and press SEND/ READY pushbutton twice.	7404A-1 monitor lamps 12—27		Lamp 12 off, and lamps 13—27 on.

Table 2-59. Interpretation of A/D Converter Monitor Word on 7404A-1 Display

7404A-1 MONITOR LAMP NO.		VALUE [( ) values are 1-volt range]	RANGE ADDRESS SETTINGS 7404A-1 BIT SWITCHES 11-15					
			11	12	13	14	15	RANGE
14	SIGN		0	0	0	0	0	10V
15	OVERRANGE (10)	10 (1)	0	0	0	0	1	10V
16		8 (0.8)	0	0	0	1	0	10V
17	ONES	4 (0.4)	0	0	0	1	1	10V
18	(TENTHS)	2 (0.2)	0	0	1	0	0	10V
19		1 (0.1)	0	0	1	0	1	1V
20		0.8 (0.08)	0	0	1	1	0	1V
21	TENTHS	0.4 (0.04)	0	0	1	1	1	1V
22	(HUNDREDTHS)	0.2 (0.02)	0	1	0	0	0	1V
23		0.1 (0.01)	0	1	0	0	1	1V
24		0.08 (0.008)	0	1	0	1	0	1V
25	HUNDREDTHS	0.04 (0.004)	0	1	0	1	1	1V
26	(THOUSANDTHS)	0.02 (0.002)	0	1	1	0	0	10V
27		0.01 (0.001)	0	1	1	0	1	10V
			0	1	1	1	0	10V
			0	1	1	1	1	10V
*LAST EIGHT ADDRESS CHECK CARD A-5			*1	0	0	0	0	10V
			*1	0	0	0	1	10V
			*1	0	0	1	0	10V
			*1	0	0	1	1	10V
			*1	0	1	0	0	10V
			*1	0	1	0	1	10V
			1	0	1	1	1	10V

Table 2-59. Interpretation of A/D Converter Monitor Word on 7404A-1 Display (Cont)

7404A-1 MONITOR LAMP NO.	VALUE [( ) values are 1-volt range]	RANGE ADDRESS SETTINGS 7404A-1 BIT SWITCHES 11-15					
		11	12	13	14	15	RANGE

Example:

15	16	17	18	19	20	21	22	23	24	25	26	27
0	0	1	1	1		0	1	0	1	0	0	0	0
		7					5				0		

10-volt range reading: 7.5 Vdc
1-volt range reading: 0.750 Vdc

GPO 789-073/227

SUPPLEMENT

TECHNICAL MANUAL

SPECIAL (DEPOT) MAINTENANCE
INSTRUCTIONS

FOR

COMMUNICATION CENTRALS

AN/TSC-60(V)1,
AN/TSC-60(V)2,
AN/TSC-60(V)3,
AND
AN/TSC-60(V)4

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

22 JANUARY 1982

1. PURPOSE.

To reflect changes to the basic manual as indicated.

2. INSTRUCTIONS.

a. On page 2-119, a WARNING and new paragraph 2-85 are added to the existing text, to read as follows:

WARNING

Fiber glass material can cause skin and eye irritation. Avoid contact with skin and eyes. Use dust respirator with adequate ventilation.

2-85. 490X-1 Antenna Coupler Fiber Glass Cover Repair:

a. Permanent repairs are to be accomplished at Depot Level by qualified trained personnel using fiber glass material as per MIL-R-7575C: Resin, Polyester and Low Pressure Laminating and Collins Rockwell Drawing No. 790-2216 for Test of Leaks.

b. On page 2-230, new paragraph 2-164 is added to read:

2-164. Replating R.F. Coils.

a. F.F. Coils, Part of Assemblies, Part Numbers 775-2472-002, 775-2472-003 and 775-2494-002 will be replated with gold in accordance with MIL-G-45204, TYPE II, when worn or oxidized to base metal.

c. On page 2-231, Step 1 of Table 2-44, just prior to the CAUTION under heading CONTROL SETTINGS AND OPERATION OF EQUPMENT, a WARNING and a new procedure are added to read:

WARNING

High voltage exists on capacitor turret when power amplifier is keyed. Death on contact may result. Turn off all power before making any inspection or adjustment. Insure capacitors are discharged prior to inspection and adjustment. Capacitor turret must be grounded while performing inspection and adjustment.

CAPACITOR CLEARANCE INSPECTION AND ADJUSTMENT

Inspect the capacitors for 1/8 inch clearance at the rear of the turret. If necessary, reposition turret and push capacitor forward about 1/8 inch. Reposition turret and recheck clearance. Inspect turret capacitors for each band position.

THE END

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INSTRUCTIONS

FOR

COMMUNICATION CENTRALS
AN/TSC-60(V)-1, AN/TSC-60(V)2,
AN/TSC-60(V)3 AND AN/TSC-60(V)4

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10 AUGUST 1983

1. PURPOSE.

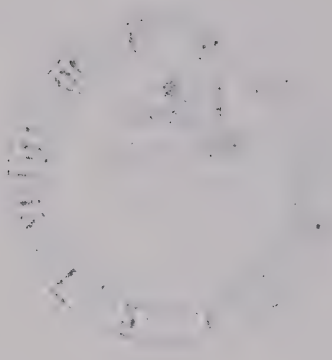
To reflect action of AFTO Form(s) 22 against the basic manual.

2. INSTRUCTIONS.

On page 2-2, Table 2-1, the following information is added:

TEST EQUIPMENT	CHARACTERISTIC
MYRIAD XK	Portable I.C. tester identifies and condition tests various types of I.C.s.

THE END



SUPPLEMENT

TECHNICAL MANUAL

SPECIAL (DEPOT) MAINTENANCE INSTRUCTIONS

FOR

COMMUNICATION CENTRALS
AN/TSC-60(V)1, AN/TSC-60(V)2, AN/TSC-60(V)3,
AND AN/TSC-60(V)4

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

14 MARCH 1984

1. PURPOSE.

To reflect corrective action generated by AFTO Form(s) 22 against the basic manual.

2. INSTRUCTIONS.

On page 2-80, Figure 2-13, change indicator for TP3 from present location to test point as shown in Figure 1 of this supplement.

TEST POINT LOCATION GUIDE
(NON-COMPONENT SIDE)

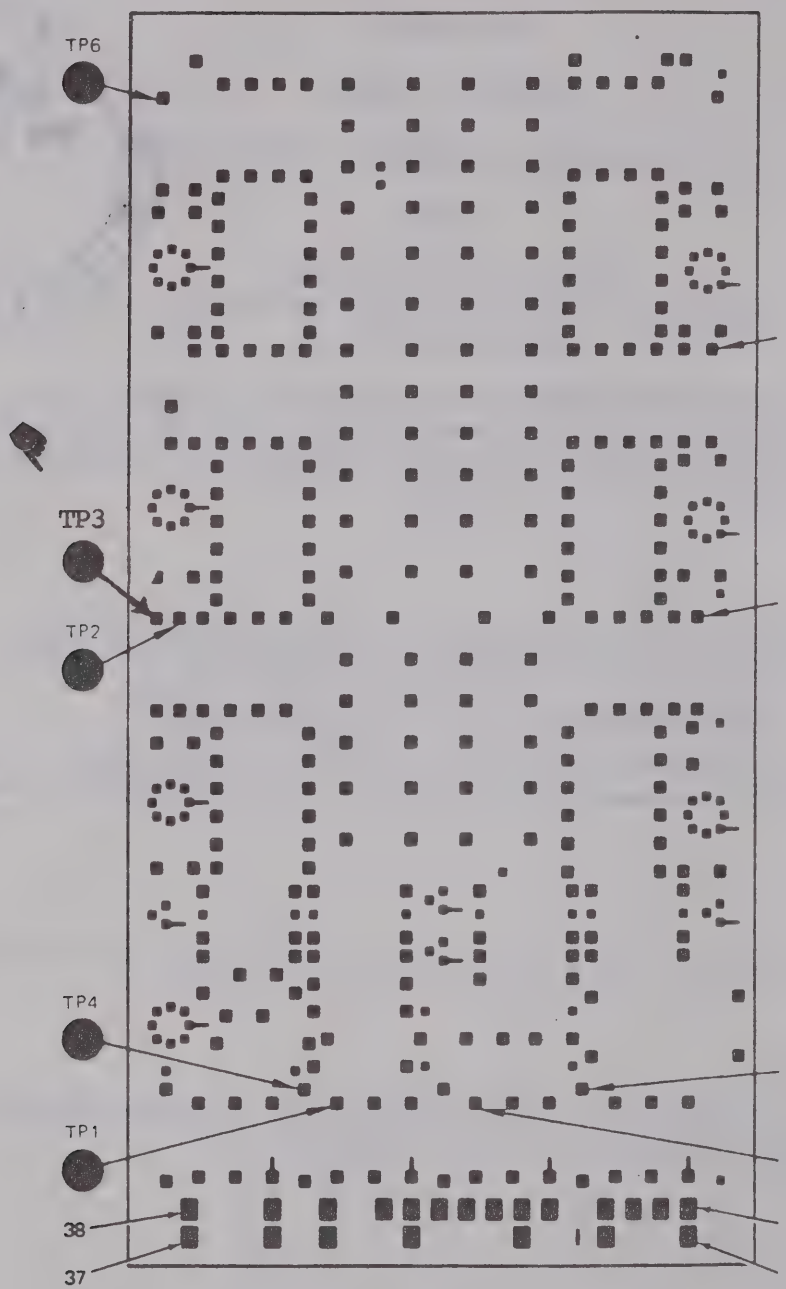

Figure 1

THE END

SUPPLEMENT
TECHNICAL MANUAL
SPECIAL (DEPOT) MAINTENANCE
INSTRUCTIONS
FOR
COMMUNICATION CENTRALS
AN/TSC-60(V)1,
AN/TSC-60(V)2,
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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

10 MAY 1984

1. PURPOSE.

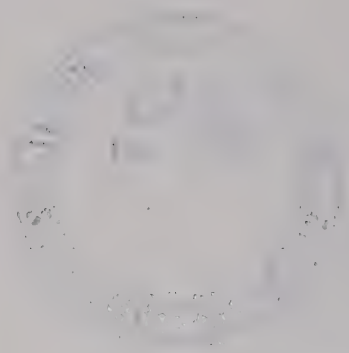
To reflect action of AFTO Form(s) 22 against the basic manual.

2. INSTRUCTIONS.

On page 2-5, Table 2-1, the following is added:

TEST EQUIPMENT	CHARACTERISTIC
Wattmeter, Bird Model 4712	Frequency Accuracy: ±.050% Measurement: Watts or kilowatts Calibration range: 0-5000W CW single scale 0-10KW CW single scale
Detecting element, Part No. 5000H1	Frequency range: 2 to 30 MHz Power range: 0 to 5.0 KW Impedance: 50.0 Ohms
Detecting element, Part No. 10KH1	Frequency range: 2 to 30 MHz Power range: 0 to 10 KW Impedance: 50.0 Ohms
Detecting element, Part No. 25KH1	Frequency range; 2 to 30 MHz Power range: 0 to 25 KW Impedance: 50.0 Ohms

THE END



SUPPLEMENT

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INSTRUCTIONS
FOR
COMMUNICATON CENTRALS
AN/TSC-60(V)1,
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25 JANUARY 1985

1. PURPOSE.

To reflect changes to the basic manual as indicated.

2. INSTRUCTIONS.

On page 2-19, Table 2-5, FSK Transmit Filter Adjustment Data (Cont) under section 773-9880-014 (F_0 = 2635 Hz), U5 under F_0 (Hz) column, 2747.0 is changed to read: 2577.5.

THE END

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TECHNICAL MANUAL

SPECIAL (DEPOT) MAINTENANCE INSTRUCTIONS FOR COMMUNICATION CENTRALS AN/TSC-60(V)1, AN/TSC-60(V)2, AN/TSC-60(V)3, AND AN/TSC-60(V)4

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16 NOVEMBER 1987

1. PURPOSE.

To reflect changes to the basic manual.

2. INSTRUCTIONS.

a. On page 2-111, the following changes are made:

(1) On paragraph 2-51.f, change to read as follows:

If only slightly out of specification, adjust A22R13 (for A22 part number 609-0699-001) or A22R10 (for part number 777-4308-001). Wait five minutes for stabilization after each adjustment. Repeat until specification is met.

(2) On paragraph 2-51.g, change to read as follows:

If quite a bit of adjustment is required, adjust A22C9 (for A22 part number 609-0699-001) or A22R29 (for A22 part number 777-4308-001) slightly and wait five minutes for stabilization. Repeat step f. above.

THE END

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